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LICENSING AND STANDARDIZATION FOR NUCLEAR POWERPLANTS

HEARING

BEFORE THE

SUBCOMMITTEE ON NUCLEAR REGULATION

OF THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDRED FIRST CONGRESS

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LICENSING AND STANDARDIZATION FOR NUCLEAR POWERPLANTS

TUESDAY, SEPTEMBER 18, 1990

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON NUCLEAR REGULATION,
Washington, DC.

The subcommittee met, pursuant to notice, at 9:30 a.m., in room 406, Dirksen Senate Office Building, Hon. Bob Graham (chairman of the subcommittee) presiding.

Present: Senators Graham and Simpson.

OPENING STATEMENT OF HON. BOB GRAHAM, U.S. SENATOR FROM THE STATE OF FLORIDA

Senator GRAHAM. Good morning. The subcommittee will come to order.

We welcome you to this hearing on improving the licensing for nuclear powerplants. On October 2, we will focus on the Federal program for the disposal of spent nuclear fuel and high level radioactive wastes. The Federal Government has a responsibility to remove unnecessary obstacles to the development and use of domestic sources of energy. This should be the cornerstone of any Federal energy policy.

The Iraqi takeover of Kuwait emphasizes the significance of this responsibility. We cannot afford to tie our own hands in meeting our energy needs, especially as long as others in the world can unilaterally shut off supplies of vital resources.

Reliance upon crisis management and military force are not prudent long-term energy strategies. We have waited too long to develop a coherent, rational, forward-looking energy policy. We urgently need to establish a comprehensive energy strategy that will allow us to develop realistic, environmentally sound domestic alternatives, and reduce our reliance upon foreign energy supplies.

This hearing will help the subcommittee to determine whether there are any unnecessary regulatory or statutory obstacles to the development of nuclear power that the Congress should remove. Nuclear power can be a safe and economic source of domestic energy. It can play an important role in keeping the air we breathe clean. It should be an option available to us. Indeed, this has been our national policy for over 30 years.

Today we will discuss two specific areas. First, we will examine the Federal Government's and the nuclear industry's efforts to promote development and use of standardized designs for nuclear pow-

erplants. There is widespread agreement that standardization of designs could improve the safety, reliability and economics of nuclear power. For example, the United States nuclear navy and the French commercial nuclear industry have used standardized designs with great success.

There is disagreement, however, as to how best to achieve this success in the U.S. commercial sector. Here, standardization is easily agreed to in theory, and more difficult to achieve in practice. Second, we will be looking at ways to improve the process for licensing new nuclear powerplants. The process that has been used for most of the plants operating today has been widely criticized. Frequently it has been denounced as being too slow, too formalized, and coming too late in the licensing process to allow meaningful or timely input to the public.

Last year the Nuclear Regulatory Commission revised its licensing procedures to try to make the process more timely, efficient and meaningful. We will be examining these new procedures. Will they make the licensing process more predictable? Will the public have meaningful input? Should the Congress take any additional steps to improve the process?

Today we will hear from several distinguished and knowledgeable witnesses on these topics. I am pleased that our witnesses include Mr. William Young, the Assistant Secretary for Nuclear Energy in the Department of Energy; Mr. James Taylor, Executive Director for Operations at the Nuclear Regulatory Commission; Mr. William Parler, the NRC's General Counsel; Mr. Sherwood Smith, the Chairman, President and CEO of Carolina Power and Light Company; and Mr. Dean Tousley representing the Union of Concerned Scientists.

I am especially pleased that we will be welcoming Mr. Pierre Bacher from Electricite de France. EDF is one of the largest utilities in the world, and is responsible for operating almost all the nuclear powerplants in France. France's nuclear program has been highly successful in providing economical electricity, while at the same time lowering air emissions and reducing reliance on imported energy.

Mr. Bacher will provide us with the important benefits of standardization. We are pleased that he is able to be with us today.

As you can see from the format, we intend this to be informal and emphasize dialogue among the participants. We would first ask our colleague, the ranking minority member on this subcommittee, and a person with a depth of personal knowledge in this subject, Senator Alan Simpson, for his opening statement before turning to the panel.

OPENING STATEMENT OF HON. ALAN K. SIMPSON, U.S. SENATOR FROM THE STATE OF WYOMING

Senator SIMPSON. Thank you Mr. Chairman. I am enjoying your leadership in this area. I think you have set an important agenda. It is nice to see that we are going to get it done, to see your strength of interest in it, and I really do commend you. You certainly are vigorously pursuing your duties as chairman of this subcommittee, one I have been on since I came to the Senate.

I appreciate your holding this hearing on these two subjects, for the future of nuclear energy and electricity supply. I like the format, I think it is a very good format. I only regret that I must continue to be involved in the Judge Souter nomination proceedings as a member of the judiciary committee, so I will not be able to remain.

But you are so right when you say that the situation in the Middle East, the current threats to our energy interests are created by this dependency on products from that unstable area. We should learn, but we don't learn. You have been very active in the Clean Air Act. I think if we get that done—and we will get that done—we will see a national energy policy begin to form, once we finish the Clean Air Act. It will force us to do things we have not been able to do before.

So I think this is a very important area. It is such a cumbersome process, something I have been watching for years. Senator Gary Hart was chairman when I arrived, then I served as chairman, and then Senator Breaux, and now you do it so capably. But this issue is, I think, one of the most important ones of all.

I have whacked away at the NRC a time or two in my life about the bureaucracy there, and the legalistics that sometimes come out of there, but I want to commend them on the progress they have made on that issue. I think there is much more to do, but they have done things administratively that I did not believe could have gotten done, and I commend them.

I think we continually must guard against, and you do—no one is trying to close off the public here, but at some point you have to close off the babbling. You can do that, and do it in a responsible way, by saying "are you here to talk about health and safety or are you here just because you hate nuclear energy in any form?" and try to cut through that business. We have to go through so much of it when we are dealing with this issue.

So standardization and licensing are critical. We have been talking about them for a long time. I think it's very good to examine the procedures, listen to the suggestions for progress towards certification. They are not new issues, they are perennials in the garden. We have had numerous hearings, and I am so pleased we are addressing them with your interests, and with your background and your education in this area, which comes from the fact that you represent a State that is critically interested. That's very helpful.

In my personal judgment, those are parts of the most important nuclear issues. The next hearing will indeed be one that all of us should pay attention to, while people just run around with placards we will decide what we are going to do with 43,000 metric tons of spent fuel in whatever year it is that we reach that.

So this is a good opportunity. I will be interested in reading the remarks of Mr. Pierre Bacher. We are pleased to have him here. That will be very helpful, having him come to the United States to share with us lessons learned.

I look forward to working with you, Mr. Chairman, and I want to introduce—and I know this is a little extraordinary—Karen Field as my new staffperson. I am proud to have her, she is a very fine professional and one of a fine chain of extremely able staff people I

have had the benefit of working with. She works well with your fine staff. Dan has been very helpful to her, and I appreciate it.

I am ready to move forward with you, and admire your willingness to get into it, and do this kind of thing in this kind of format. It is a pleasure to work with you.

Senator GRAHAM. Thank you very much, Senator.

What I would like to ask the participants to do this morning is to make a short summary statement of approximately five minutes, so that we can turn to questions, both questions from us, and I hope a full interchange among the participants. All of the statements that have been filed will of course be printed in full in the record.

Mr. William Young, Assistant Secretary for Nuclear Energy of the U.S. Department of Energy, is our first speaker. Mr. Young.

STATEMENT OF WILLIAM H. YOUNG, ASSISTANT SECRETARY FOR NUCLEAR ENERGY, DEPARTMENT OF ENERGY, ACCOMPANIED BY MR. DAVID McGOFF, ASSOCIATE DEPUTY ASSISTANT SECRETARY FOR REACTOR DEPLOYMENT

Mr. YOUNG. Thank you, Mr. Chairman.

I am pleased to have this opportunity to briefly present the Department of Energy's views on commercial nuclear power-plant standardization and licensing. A more detailed statement of the Department's position on these matters has been submitted for the record.

Before I begin, I would like to say that I am accompanied this morning by Mr. David McGoff, who is the Associate Deputy Assistant Secretary for Reactor Deployment.

Nuclear power is a key element of the Nation's energy base. It supplies about 20 percent of our electricity, our second largest source. It appears that utilities will require over 250 gigawatts of new capacity in the next 20 years. An order would have to occur by the mid-1990s to have a new nuclear plant, most likely an Advanced Light Water Reactor plant, operating by 2000 or shortly thereafter. The Department's ALWR programs are designed to provide the free market a choice of viable new nuclear powerplant options in that timeframe.

The Department believes that standardization of new nuclear powerplant designs is an essential element of the future nuclear power program in the United States, to avoid the multiplicity of designs that characterized past experience. At the same time, standardization must be structured so as to enable competition and free market forces to operate.

Standardization will contribute to the viability of nuclear power by improving the safety, reliability, and economy of nuclear energy. Standardization of safety systems will assure that the plant behavior is well understood and that components and systems will be less susceptible to the uncertainties and pitfalls associated with design changes.

Standardization will improve the reliability of nuclear power by designing quality plants that would minimize unplanned shutdowns. Standardization should improve the economics of nuclear energy by minimizing the need for individual licensing reviews and

approvals for each plant, thereby reducing and providing certainty for the time required for the licensing process.

Standardization will also assure economic viability and financial certainty by first fixing a standard design that can be a basis for firm cost estimates and construction schedules, and next providing for construction of replicate plants with provision for competitive procurement of components and materials.

The Department sees standardization occurring in two successive and distinctly different steps. The first step is design certification by the Nuclear Regulatory Commission on the basis of safety considerations, which will provide for standardization of plant safety functions. The second step is commercial standardization for economic and other reasons, which would be carried by industry with support from the Department.

The Department views commercial standardization as a process apart from, and beyond, NRC plant safety certification. We believe the NRC regulatory process should be the vehicle for assuring standardization only to the level necessary to assure safety and should not be the vehicle for attempting to achieve standardization for economic and other purposes.

DOE has approached design certification with free market principles in two ways. First, four designs are being sponsored by DOE for NRC certification. Second, standardization of the individual designs, with provisions for competitive procurement of equipment and materials, is the basis for the certification we are proposing.

All four designs will meet utility standardization requirements reflected in the Electric Power Research Institute Requirements Documents. We believe this approach provides for the construction of only a limited number of certified standardized plants while still permitting adequate free market competition.

There has been considerable discussion over the past several months regarding the level of design detail required by the NRC to permit safety certification. In an August 31, 1990 letter to the NRC, the Department pointed out that the level of design detail necessary to permit NRC safety decisions to be made and designs to be certified will be available for submittal by the reactor manufacturers under four contracts the Department has with them.

The Department is presently in the process of establishing approaches to achieve commercial standardization. Working with industry, DOE is defining the level of design detail that could provide commercial standardization for the ALWR. Consistent with the approach to standardization that provides for competitive procurement of equipment and material, the extent of completion of the design of an ALWR plant is being defined in such a way that is independent of prior orders for, or construction of, such a design.

Completion of an ALWR design up to the point of commercial standardization should establish whether utility industry cost, schedule, and reliability targets, as specified in the EPRI Requirements Documents, will be met.

The Department is also considering support of first-of-a-kind engineering and design efforts to provide for commercial standardization. We will inform Congress of our recommendations in this regard in our fiscal year 1992 budget submission. We will be better able to determine the need for legislation to promote commercial

standardization as we define our program in our budget proposals for fiscal year 1992.

In 10 C.F.R. Part 52, NRC requirements for a utility or other party to obtain pre-approval of a site are listed. The Department is planning a demonstration of this process and recently issued a Request for Proposals. We hope to select at least one participant and award a contract during fiscal year 1991. Our purpose is to have at least one early site permit awarded by the time the design certification program is completed.

During the course of collecting the information from which the National Energy Strategy will be developed, the nuclear licensing process was identified as a factor likely to diminish the future expansion of nuclear energy use in the United States. The utility industry and the financial community are reluctant to risk investment in nuclear power unless they can have reasonable assurance that a plant can be operated without undue delay when it is ready for operation.

The NRC took a major step forward when it issued 10 C.F.R. Part 52 and identified the criteria necessary to achieve design safety certification. However, the NRC has acknowledged to Congress that its rule does not address or improve certain aspects of emergency planning. It also does not eliminate the possibility of lengthy procedural delays when a plant is ready for operation.

The post-construction hearing process has repeatedly been identified as a most important aspect requiring meaningful reform. Essentially completed and operational plants must be permitted to initiate power production and not be delayed until a lengthy and unbounded hearing and appeal process is completed.

In developing the NES, we will be addressing the issue of a fully satisfactory regulatory process. Consideration will be given to legislation addressing codification of the NRC rule, and addressing the second hearing and emergency planning. A decision on the need for this legislation will be made after the NES process has been completed.

I thank you for this opportunity to present the Department's views. I would be pleased to answer your questions.

Senator GRAHAM. Thank you very much, Mr. Young. It is my intention to have all the opening statements, then go to questions and discussion.

Mr. James Taylor, Executive Director for Operations, of the U.S. Nuclear Regulatory Commission, is our next speaker. Mr. Taylor.

STATEMENT OF JAMES M. TAYLOR, EXECUTIVE DIRECTOR FOR OPERATIONS, NUCLEAR REGULATORY COMMISSION, ACCOMPANIED BY WILLIAM C. PARLER, GENERAL COUNSEL, NUCLEAR REGULATORY COMMISSION

Mr. TAYLOR. Thank you, Mr. Chairman.

I am pleased to appear before you and the subcommittee today to report on the NRC's activities related to standardization of new reactor designs and the licensing process for nuclear powerplants. I am presenting this testimony on behalf of myself and Mr. William Parler, on my left, the Commission's General Counsel. Other members of our staff are also here with us this morning.

As the subcommittee knows, the NRC has for some time encouraged the concept of standardized nuclear powerplants. Most recently, in April 1989, the Commission promulgated its standardization and licensing reform rule, 10 C.F.R. Part 52. A number of NRC review activities related to standardization under Part 52 are taking place. My full testimony addresses the subjects you raised in your letter of September 6, 1990, and I will briefly summarize.

The NRC has long sought nuclear powerplant standardization because of the safety benefits which standardization is expected to bring. In the fall of 1987, the Commission issued a policy statement encouraging nuclear powerplant standardization. In part, this policy set forth the fundamental safety judgment underlying the licensing reform and streamlining initiatives carried out by 10 C.F.R. Part 52.

The Commission finds a direct relationship between safety and design standardization, and also believes that a high level of design detail at the design certification stage will minimize diversity among individual plants which reference a certified design. This minimization of diversity is expected to have a safety feedback.

There are policy issues regarding standardization which are still under consideration by the Commission. One such policy issue now before the Commission involves the level of design detail necessary to achieve design certification under Part 52. After considering all of the relevant information on the subject, the Commission expects to reach a decision on the required level of design detail this fall. The staff is currently hard at work on that subject.

After the Commission decision on this issue, the Commission will reevaluate the schedules that were previously published and the resources for design certification activities and will forward the schedules and resource information to the Committee.

I would like to discuss some aspects of the licensing process. The construction and licensing of the current customized designs under the existing two-step licensing process has proven in many cases to be inordinately time consuming. This has resulted in a relatively large commitment of resources for the processes of design, construction and licensing review. It is apparent that the two-step licensing process needed to be changed.

In recognizing that its licensing regulations could be improved, the Commission issued 10 C.F.R. Part 52, the NRC's standardization and licensing reform rule, to address the problems identified by past experience. The principal objectives of the new rule are a more efficient licensing process and the safety enhancements which are expected to result from standardized nuclear powerplant designs.

To these ends, the regulation facilitates the early resolution of safety issues by providing for Commission certification of standardized designs, pre-construction permit approval of powerplant sites, and the issuance of licenses that combine permission to construct a plant with permission to operate it once construction has been successfully completed.

On review status, we consider future reactor designs to fall into three categories: evolutionary light-water designs; advanced passive light-water reactors, and advanced non-LWR designs. The specific designs we are reviewing, or anticipate reviewing, in each of these

three categories, are identified in the attached table. These designs are standard plant designs which we generally expect will have design certification as their ultimate objective.

In addition to the specific designs being reviewed, the Commission is or will be carrying out reviews of the Evolutionary LWR and Advanced Passive LWR Utility Requirements Documents being prepared by the Electric Power Research Institute.

For the evolutionary LWRs, our technical reviews are well in progress and were previously scheduled to be completed in the 1990–1992 time frame. We had planned to complete our review of Evolutionary LWR Utility Requirements Document in 1991 and the Advanced Passive LWR Utility Requirements Document in 1992.

For the advanced non-LWRs, we are still in the conceptual design review stage, and are working closely with the Department of Energy on those reactors, which include the modular high temperature gas-cooled reactor and the power reactor inherently safe module, PRISM.

To facilitate the certification of standard plant designs, the Commission is focusing its attention on the policy issues that are being identified as the first evolutionary light-water reactor design are being reviewed. The Commission is also focusing its attention on the 600 megawatt advanced passive light-water reactor designs, which are the next class of plants for which the Commission expects to receive requests for certification under 10 C.F.R. Part 52.

Although agency review of key policy matters may affect the schedules of these first three designs, the Commission believes that certification under Part 52 can be effectively implemented only if key policy matters are considered by the Commission early in the review process, or as in the case of the passive and non-light-water reactor plant designs, before the actual certification reviews begin. As stated earlier, the Commission will reevaluate the review schedules after deciding the key policy issue of level of design detail this fall.

The Commission believes its ongoing activities will successfully resolve the pending certification issues. Also, the current regulations, 10 C.F.R. Part 52, provide an adequate and workable mechanism for future licensing of nuclear power plants. Therefore, the Commission believes that legislative changes are not needed at this time.

Although the Commission is not recommending enactment of legislation, the Commission is reviewing various aspects of its licensing requirements to assure compatibility with the principle underlying Part 52 that safety issues be resolved early in the licensing process.

For example, the Commission is also examining its emergency planning regulations, particularly the role of emergency planning exercises, and whether the Commission's siting regulations should be revised to clearly differentiate between siting and design considerations. The Commission will make any necessary changes to its regulations after it completes its review.

The ultimate objective is to focus potential hearings after the issuance of the combined license on matters such as whether the plant was constructed in conformity with the combined license.

That concludes my statement.

Senator GRAHAM. Thank you very much, Mr. Taylor.

Mr. Parler, do you have any further amplification?

Mr. PARLER. No, I do not, Mr. Chairman. I certainly wish to express my appreciation for the opportunity to be here. I will be pleased to respond to any questions you may have, and to assist the subcommittee in any way.

My responsibility and role in this important area has been principally with respect to the licensing process and questions about the authority that the agency has to proceed as it has under Part 52.

I have nothing else to add at this time, but I look forward to questions and participating in the discussion that will follow.

Senator GRAHAM. Thank you very much, Mr. Parler.

Mr. Sherwood Smith, Chairman, President, and CEO of Carolina Power and Light Company.

STATEMENT OF SHERWOOD H. SMITH, JR., CHAIRMAN, PRESIDENT, AND CEO, CAROLINA POWER AND LIGHT CO.

Mr. SMITH. Thank you, Mr. Chairman.

I am pleased to be here today to present the views of the nuclear energy industry on the importance of standardization and licensing reform and the need for the industry, the Administration, the NRC and the Congress to work effectively to overcome the obstacles to nuclear power development.

Nuclear energy gives America the power of independence. My company built the first nuclear powerplant to go into operation in the southeastern part of the United States. In fact, it was almost 20 years ago to this day when I toured the plant, when we were preparing to load fuel. We have had a great deal of experience in both of the Carolinas. We operate four nuclear units. I have personally witnessed the disastrous effects caused by delays in the planning, design, licensing and construction of nuclear powerplants.

My statement today has been filed for the record on behalf of the American Nuclear Energy Council and the Edison Electric Institute. I will briefly summarize, if I may, as suggested by the Chairman.

The entire electric utility industry, the utilities themselves, the manufacturers, the architects and engineers, the entire infrastructure for the American public wants and needs to be able to include nuclear energy in the planning for new baseload electric capacity. Electric consumers, we believe, for both economic and environmental reasons, need to have this option for a successful American future. Specifically, our industry would like to be able to order and begin construction of new nuclear plants within the next several years, so they could possibly be in operation as soon as the turn of the century.

We want to be able to place a new order in the mid-1990s, in order to meet a growing electric demand for our consumers. To do this, several critical issues need to be resolved, including certification and licensing reform issues.

We believe that nuclear energy powerplants will be economically competitive in the 1990s if obstacles now preventing the utilities from ordering them are removed. Some of the necessary steps to

remove these obstacles are beyond the limits of what the industry can accomplish by itself.

We do believe there is a need for legislation to remove certain obstacles to nuclear energy development. We commend the NRC and the staff for the rule that has been promulgated as of April of 1989. We think it is a giant step forward. But we do believe that in order to assure the industry and the consumers who would buy electric power from the nuclear plants that there will be a stable and predictable process that the licensing reforms which we are discussing should be enacted into legislation.

There are other things that are needed, of course. We believe it will take legislation to move forward and give DOE the authority to characterize the Yucca Mountain site in Nevada. We think there is certainly a need to clarify the responsibility for regulating radionuclide emissions and there is a conference on the Clean Air Act now where under title 3 the Air Toxics provision is pending. We think that needs to be clarified.

While there have been many reasons for plant cost overruns, plant cancellations, I believe some of these are very well summarized in Mr. Taylor's pre-filed testimony. One of the greatest variables we have had in the cost of our nuclear plants are changes during construction and the length of the construction period. We think standardization and licensing reform will substantially reduce construction costs by preventing unnecessary design changes during construction and requiring resolution of design and licensing issues before construction.

Under the previous process, many final decisions regarding design safety, siting and other licensing issues, were resolved only after issuance of the construction permit and after construction had already begun. We think delays in the resolution of these issues had a very serious and adverse effect on the cost of the plants, and on their availability to serve the public.

In the 1970s and 1980s, it took anywhere from six to 20 years to build and license nuclear plants in the United States. On average, it took 14 years. This compares to five years in many other countries, including France. Given the variable length of construction periods in our country, under the previous and still existing licensing process, it should be no surprise that there were wide ranges in the cost of nuclear plants.

In the 1980s, the completed plant cost ranged anywhere from $1.6 billion to $6 billion, with the average being $3 billion. I noted that Table 13 attached to the statement presented on behalf of EDF indicates that well over half their plants were completed within less than 70 months, less than six years. We can do that. We think we may even be able to do better than that, if we have licensing reform and some of the other obstacles are removed.

Based on some of our industry studies, we think standardization and licensing reform can reduce plant construction costs by perhaps as much as 55 percent. We think standardization could reduce 10 percent of the direct and indirect costs, and we think an improved licensing and construction process, which could lead to operation within six years after construction has begun, could perhaps reduce total plant costs by as much as 45 percent.

Referring back to the NRC rule that was promulgated in 1989, which again we commend very highly, the rule does go far dealing with early site permits, certification of designs, combined licenses. All these are necessary steps. But the most important benefit, we believe, for the final rule, is that it will increase the certainty regarding exactly what sort of facility will be built, and therefore it will be possible to determine how it is expected to operate, how much it will cost, and when it will be completed.

As to design certification, which is under consideration now by the NRC, and there has been considerable interaction between the industry and the NRC, and we believe substantial progress is being made on this question, we think it necessary to have a level of standardization which is sufficient to assure the public and the industry and everyone of the safety of the plant.

Some plant designers have submitted designs for certification already that could take place under 10 C.F.R. Part 52. There are others, including some foreign companies, that have expressed interest in applying for design certification under the rule after it becomes final.

As in the case of early site permits, there would be public hearings. Certainly the public should have an opportunity to express its views, to ask all its questions, early in the proceedings. Those questions must be satisfactorily resolved before proceeding. But once those questions have been resolved, then we believe the process should not be subject to being twisted and used for purposes of delay simply to frustrate the development of new nuclear power plants.

Since last year, our industry has been working with the NRC on the implementation of design certification. We have explained our position to the Commission and had a meeting with the Commission approximately one month ago. We believe that it is important for the designs to be certified by the early 1990s to allow electric utilities to consider ordering nuclear power plants within the next several years. We believe the evolutionary light-water designs should be able to be certified by the period of 1991–1992, and the passive light-water designs by 1994–1995.

The level of detail required for design certification should be that necessary to make all important safety determinations. We do not believe, however, that a level of detail for design certification should be required that goes well beyond the current level in the proposed rule. We think many of the standardization questions are economic questions rather than safety questions, once we move beyond a certain level of detail.

We have suggested that the NRC adopt what has been called a two-tier approach to certification. Tier one would describe the certified portions of the design, and tier two would identify the portions which were not certified or reviewed and approved in the rulemaking proceeding period.

It is certainly important that there be no delays in the schedule for certification of these advanced reactor designs. The utilities will not be able to consider ordering new nuclear plants under Part 52 until these designs are certified. To that extent, the certification process controls the schedule within which we will be able to consider ordering new nuclear plants.

We note that Congress has recently recognized the need for timely completion of those design certification processes, and the report accompanying the fiscal year 1991 Energy and Water Development Appropriations Bill approved by the Senate in August expressed interest that there be no slippage in the certification schedule.

Next, as to the question of combined licenses, under the previous licensing process, two licenses were needed to authorize construction and operation. Certainly consolidation of these licenses into a combined construction permit and conditional operating license, called a combined license, will substantially improve the process. We think this is essential before anyone will have any confidence in going forward.

Although the NRC has expressed the view in its Congressional testimony and in public statements that under the proposed rule, as the rule itself says, the opportunity for hearing at the operational stage is limited, our industry remains very concerned about the prospect of pre-operational hearings, perhaps of indefinite duration.

No one knows what a court many years from now might do in terms of interpreting such a rule, and there is a possibility that a court could exercise wide latitude and discretion and decide that a hearing of adjudicatory nature should be given about something which nobody today would assume possible. That threat is a tremendous deterrent to us.

In conclusion, we do feel concern about the possibility of a pre-operational hearing. I think that perhaps is our greatest concern with respect to the proposed rule. Of course, the rule itself is now being challenged in the courts, and this question of whether or not a combined license may be issued by the NRC under section 161(h) or whether the broader language of section 185 dealing with the Commission's duty to determine prior to operation that the facility has been built in accordance with plans, there is a conflict there that would interfere with this rule.

Certainly, legislation will clarify that once and for all, that the Commission does have the right to issue a combined license, and it would be possible in that legislation to proscribe and prevent the opportunity for serious abuse later on.

We have talked with the financial community about our goal to build more nuclear power plants, all aspects of it. The financial community has expressed concern with regard to whether or not a rule that did allow for the possibility of an pre-operational hearing, even though that hearing may be somewhat remote, is a substantial financial impediment that might limit our ability to raise the capital to build the plant.

As I said, we do consider the rule to be a giant step forward. We do feel there is progress being made, and we commend the NRC and their staff for their diligent work on the design certification, and we very much look forward to being able to report back to you, Mr. Chairman, and other members of Congress that in due course we have a design that is certified, and we do have an order in the works.

Thank you.

Senator GRAHAM. Thank you, Mr. Smith.

Mr. Dean Tousley, representing the Union of Concerned Scientists.

STATEMENT OF DEAN R. TOUSLEY, ON BEHALF OF THE UNION OF CONCERNED SCIENTISTS

Mr. TOUSLEY. Thank you very much, Mr. Chairman.

We appreciate the opportunity to have our views heard in this high-energy panel today.

UCS supports the principle that standardization has the potential to enhance overall nuclear power plant safety if safety enhancement is the explicit objective of standardization. The Commission should first declare that the primary purpose of standardization is to significantly enhance safety. It should then issue significantly enhanced safety standards that any designs will be required to meet. Then it should select one or two, or at most three advanced designs to best meet those standards.

Those advanced designs should be virtually complete in their level of design detail and should be required to undergo prototype testing prior to their certification. Standardization will not be achieved if certification is not based on essentially complete designs. As we have heard this morning, the utilities and DOE are unwilling to commit to a specific and detailed design to be standardized. They seek a regulatory regime that would allow NRC to approve designs so minimal in detail that they have been described by some as "wishful thinking" and "cartoons."

As Mr. Taylor explained, the Commission has still not decided on what level of detail to require. Chairman Carr and to a lesser extent Commissioner Curtiss are reported to want standardization based on essentially complete designs. UCS agrees with Chairman Carr on that issue.

In a tremendous irony, the utilities and DOE, after getting rid of the two-step licensing process, now insist that they must still have designs approved in a two-step process. This is the antithesis of standardization. There will be so many variations and modifications on the certified designs that there will be no more standardization than there is now.

The Commission has promulgated a rule that oversteps the bounds of both good policy and of the law. In the name of early resolution of issues, the rule has provisions that make impossible to ever meaningfully consider some important safety issues and that unreasonably locks out safety improvements for decades.

The Commission's rule provides for issuance of a combined license comprised of a construction permit and operating license with conditions. It limits any post-construction hearings to whether the tests, inspections and acceptance criteria in the combined license have been met. Post-construction challenges to the terms of the combined license itself, including the acceptance criteria, have to be brought under the Commission's very high threshold show-cause provision for seeking to modify, suspend or revoke a license.

This is unacceptable, both as a matter of policy and as a matter of law. Section 185 of the Atomic Energy Act requires the Commission to find, before issuing an operating license, that a facility has been constructed and will operate in conformity with the Atomic

Energy Act and the Commission's regulations. The Commission errs in thinking that it can solve all construction related issues prior to construction and deny a hearing on those issues at the end of construction.

As a matter of law, the Commission may not issue an operating license until after making the Section 185 post-construction findings of compliance. Any safety related issues that have not been resolved prior to construction or dealt with comprehensively by tests, inspections and acceptance criteria, such as quality assurance or new information, must be open to potential litigation in a post-construction hearing.

Section 185 does not permit the Commission to issue any kind of operating license, even a conditional one, until after construction is completed, or virtually completed, and it is found that the facility has been constructed and can operate in conformity with the requirements of the AEA and the Commission's regulations.

Among the Commission's most regrettable mistakes is the fact that it has failed to require satisfaction of enhanced safety goals in order for designs to qualify for certification as standard designs. Thus, the Commission shows an imprudent willingness to certify designs that, according to its own estimates, present a 45 percent risk of severe core melt accident in the next 20 years.

The Commission's rule should specify that design certification will be forthcoming only for designs that can satisfy new, enhanced safety criteria. Such a requirement would provide strong stimulus for the development of safer designs, as well as contribute substantially to creation of better public confidence and trust.

Ironically, the Commission's rule may actually act as a disincentive to the development of safer plants. The rule improperly permits standardization based on existing or evolutionary designs, but properly requires prototype testing as a prerequisite for certification of advanced designs. Thus the rule presents a powerful economic disincentive to the safer plants, since it will be much more costly to obtain their certification.

The prototype testing requirement for advanced designs is entirely appropriate. The consideration of certifying current or evolutionary designs is not.

Public acceptance of nuclear power also requires that standardized designs be limited to safer plants. Recent public opinion polls show that the majority of the American public has a low opinion of this industry, and does not favor construction of more nuclear plants. The public clearly will not support a resurgence of nuclear power in this country based on plants that are only comparable in safety to Three Mile Island.

In the name of standardization and stability, the Commission has implemented an unjustifiably extreme form of backfit limitation in each aspect of Part 52. Early site permits and standard design certifications have durations of 20 and 15 years, respectively, and may be renewed based on the standards in effect at the time of initial issuance, rather than the standards in effect at the time of renewal.

It is the antithesis of the Commission's responsibility to ensure adequate protection of public health and safety for it to lock out possible safety improvements for such long periods of time. It is es-

pecially absurd to do so when the entities being protected against new requirements are not physical facilities, but merely unrealized permits.

An inescapable result of the Commission's recent rule changes will be to further damage public attitudes toward nuclear power. For example, when a notice of application for a combined license is published, citizens in the vicinity of the proposed plant will inevitably wish to challenge both the site and the design. They will be told "We approved this site 30 years ago. Where were you then? The site still meets the requirements from 30 years ago, so you may not challenge it now."

They will also be told "We approved this design by rule 25 years ago. Why did you not submit comments then? Even though the design does not meet all of today's requirements, it still meets the design requirements of 25 years ago, so you may not challenge it now."

You can well imagine the impact this Catch-22 will have on public confidence in nuclear technology and its regulation by NRC.

Thank you very much.

Senator GRAHAM. Thank you, Mr. Tousley.

Mr. Pierre Bacher of EDF.

STATEMENT OF PIERRE BACHER, DEPUTY DIRECTOR, DIVISION OF PLANT DESIGN AND CONSTRUCTION, ELECTRICITE DE FRANCE, PARIS, FRANCE

Mr. BACHER. Thank you, Mr. Chairman, for your invitation to come here. It is a great honor to be here in this distinguished panel, and I only regret that Remy Carle was physically not able to come today.

You have asked that I report on the French experience of standardization, and give some hints as to what the future may be. Let us look first at the past. In 1973, France was dependent on imported energy up to 75 percent. During the first oil crisis, the French government set a national goal, to reduce dependency to less than 50 percent by 1990. Our national policy was to do this with nuclear energy, replacing fossil fuel powerplants with nuclear plants.

France had no oil, no gas, no coal. It had no choice but to use nuclear power. The standardization policy was the utility response. In a rather small country like ours, with one-fifth of the United States' population, one-tenth of its gross national product, it was simply impossible to build and operate 50,000 megawatts by 1990 by any other means.

So this is what was done, basing our program on the American Westinghouse technology, with full support of the government, of Parliament, and all the government agencies, and on the whole, with local support.

Standardization was carried out very far. Systems, layout and components, in order to benefit from cost reductions and design and manufacture, from learning curve effects and erection, startup and operation, and from a unique feedback of operating experience. The first of a kind unit in each series gave rise to lengthy instructions which are the French equivalent of ACRS in the NRC.

I personally attended about 100 meetings for the first 900 megawatt unit. Licensing effort was divided by 10, with later units bearing mostly on-site determinations. The French licensing authority agreed that stepped changes in regulatory requirements should occur only on each new series, provided that the utility could backfit into all the existing units whatever improvements were deemed absolutely necessary on safety standards, such as a number of lessons learned from Tier 9.

This of course is what we did. Over the past 10 years, backfitting 900 megawatt units has increased the initial capital cost by 10 percent.

Critics of the standardization policy have often pointed out that there was a major risk of generic failures in attaining the simultaneous shutdown of many units. We have had several generic problems. At least three have occurred on the 900 megawatt units and two on the 1,300 megawatt units.

But each of these series reverberated about 10 percent for one or two years, which is serious but not catastrophic. All in all, standardization of the French program has been very successful, and the national goal set for 1990 has been met. The cost of electricity is much lower than in all other European countries. Availability is high, close to 80 percent for the 900 megawatt units, and safety is at a high level with few safety significant events.

So is the quality of operation, in particular low exposure to the operators, and so on.

What is next? While the U.S. nuclear program draws close to a standstill, utilities in Europe have continued to develop advanced evolutionary reactors, standardized reactors. This is the case for Convoy in Germany and N-4 in France. We expected to order a few more N-4 units before the end of the present decade, one next year, for instance. Thus we are pursuing a policy of standardization.

Much later, in 2010, or 2020, or 2030, liquid metal reactors will be necessary to make the best use of available fissile materials. European countries are preparing a standardized European liquid metal reactor. Whatever the success of such a design, power generation will require a cocktail of liquid metal reactors and light-water reactors.

Moreover, existing European light-water reactors will be getting old, 30 to 40 years old, in 2010. Replacement units will have to be ordered around the year 2000. All of this points to the demand for new designs by the turn of the century. European utilities are presently getting together to have common requirements, a necessary first step toward European standardization. Licensing authorities are also moving towards common or very similar regulations, enabling countries such as France and Germany.

What size reactors? Surely not small reactors, which are not economical in the European conditions. With a large, dense European network and a scarcity of sites, unit size will be somewhere between 1,000 and 1,500 megawatts.

Evolutionary or revolutionary? Most probably in Europe, evolutionary, for obvious reasons. First of all, the safety and quality of existing plants, but more so because of the build up of experience and the potential for improved safety.

Active or passive safety? No ideology. If design were to be judged on its own merits, and of course its proven or unproven technology, gravity, since Isaac Newton, is known to have great merit. But pumps also have merit. We all like active safety on our motorcars.

What we are pretty sure of is that there is little chance that any objective such as passive, inherent, active, and so on, will enhance public acceptance. What we feel are necessary conditions for renewed public support are the identification of a long-term need for nuclear energy, together with energy conservation, and with whatever renewable energy is available.

Two, convincing evidence that long-term storage of radioactive wastes is an acceptable legacy for future generations. Three, outstanding quality and safe operation of existing plants.

Mr. Chairman, thank you for your patient attention, and I will try to answer any questions you may have.

Senator GRAHAM. Thank you very much for that very helpful statement of how another country with many similarities to the United States has dealt with this issue.

I would like to start the questioning with a question to each of the panelists, and that is to ask you to assume the role of a diagnostician. The patient has arrived, and the patient has some of the following characteristics. No plant has been ordered since 1978. There seems to be a relatively low level of public confidence in the industry. That confidence reflects in some important segments of the community, particularly the financial community's reticence to support new construction.

The environment in which the patient has arrived in the office is one of increased national concern about our high level of dependence on unstable areas of the world for significant amounts of our energy. In summary, that is a description of the patient as he arrives in your office. I would like each of you to briefly summarize what you think is wrong with that patient. Why has the industry and the process gotten into this shape?

Mr. Smith.

Mr. SMITH. Mr. Chairman, I believe that you have correctly summarized the condition of the patient who now arrives before the American people. I think a little further data underlying the diagnosis might be useful.

The reason we have not had a new order since 1978 lies perhaps more in the fact that the demand for electricity leveled off below the rates at which it was expected to rise, certainly before the 1973 Arab oil embargo, and even between 1973 and 1979, the second crisis triggered by the Iranian situation.

If you look back at the figures that in the 1970s we have some 70 out of 100 plants that might have been ordered in the mid-1970s that were cancelled, the largest reason for the cancellation was because the rate of growth slowed down. Now when we look at the rate of growth, we see that while energy usage in the country has more or less leveled off, the rate of increase in electrical consumption, while it is lower than the estimates of 10 years ago, is still moving steadily along, pretty much with GNP, about two and a half to three percent a year.

The low level of public confidence in building new nuclear plants is probably a symptom of a root cause that is a low level of public

confidence based on the lack of a perception of need of building any new large baseload electric facility. We do have this symptom or this syndrome in this country of "Yes, we need a facility, but please don't build it in my backyard."

I don't think we are going to change public opinion in localities very much about their own views on large facilities of any kind. I think the main reason the public does not say yes if you ask them if they want to see another nuclear plant built simply means that they don't realize that we will have to build more plants, either fossil or nuclear, in the future, if we are going to have an adequate supply of electricity.

The USCEA, the Committee for Energy Awareness survey, shows that an overwhelming majority of the people, between two-thirds and 70 percent believe that nuclear power will be an important part of our energy future. So I think that perhaps modifies the question or the appearance of lack of public confidence in building a new nuclear plant.

The public is also concerned about the cost of power from those plants, and that is related to the financial community's point of view. The cost of that power can be substantially reduced, as pointed out in my statement, by building a plant on a standardized design within five to six years.

If you can reduce the cost of the plants by perhaps as much as 55 percent for standardization short of licensing and construction times, you are going to go a long way toward restoring not only the public confidence generally, but the confidence of the financial community. I think you would certainly eliminate the risk of prudence disallowance by State commissions.

Regarding your last point, we do have a high dependence on foreign oil. I believe the President spoke to that in his address to the Congress last Tuesday night, and pointed out that it was important that we do reduce our dependence on foreign oil. We will have to take steps to make broader use of coal, natural gas, and as he said nuclear power. As I said initially, nuclear energy gives Americans the power of independence. That's our view.

Senator GRAHAM. Other diagnosticians—to what do you attribute the state of the patient?

Mr. YOUNG. Yes, sir. I would agree generally with the comments Mr. Smith made. I think in terms of the situation of no orders since 1978, that does result primarily from the electricity supply situation, where there was excess capacity. But I think very rapidly in the 1990s we are going to see that situation change drastically, which is why DOE is targeting its programs to be ready by the mid-1990s for utilities to have an opportunity to order nuclear plants.

I also agree that the lack of public confidence is more broad than just nuclear plants. Again, I believe that there has not been a significant focus on energy in general, and for quite a few years. I think the shocks we are into today, and the situations we see developing in the 1990s as to the need for new electrical generating capacity will serve to focus public attention on that question very strongly, and that we look to the programs we have in process as providing evidence to the public that thinking has gone into the safety of these plants and their readiness to be operated safely.

As to the financial reticence, again I think basically it comes down to the utilities' uncertainty and a poor track record from a process that has led to cost growth. We are trying to put in place by the mid-1990s several things that would address that uncertainty and the cost growth that resulted.

One is certifying designs so that there is not substantial design change during construction. Second is a program of what we call commercial standardization, which would be going further to permit plants to be priced very accurately, to give the financial community and the potential buyer high confidence that he would be building something that would have a certainty of time and cost associated with it.

Lastly, the licensing process is also a very important part of that certainty. We see fixing that process through the NRC rule and perhaps a few improvements in legislation, as giving again the owner and the financial community the kind of confidence they should have so that they could make a long-term investment and have a return on that, the completion of it, within a certain time.

I think what I am trying to say is that there have been good reasons for the lack of orders. I think those circumstances are changing both through national and world conditions, and through the efforts we—the NRC and the industry—are trying to put into place to change the conditions so that such orders can occur.

Senator GRAHAM. Mr. Tousley.

Mr. TOUSLEY. I think I would redefine the patient a little bit, to say that the patient is not just the nuclear power industry, but the country and its energy policy. What happened in the 1970s, I agree with a lot of what Mr. Smith said, the demand for electricity leveled off when the cost went up. The economics of producing energy that way got very bad.

There are quite a few utilities in the country that are having a lot of economic problems because of the nuclear plants they built. There are areas of the country that have had great increases in electric rates because of the nuclear plants that were built, and these are in many cases plants where licensing was not particularly problematic, they had pretty smooth licensing proceedings.

As to the confidence, it is certainly true that the public has a great deal of aversion to lots of large facilities appearing next to their homes. It is difficult to site landfills, for instance, any more. But I think it is also certainly correct that the aversion to nuclear plants is considerably higher than it is for anything else.

If the Government and industry do not seriously address why it is that the public feels this way about this technology, there will be no resurgence of the nuclear option. It will not be possible to shove this down the throat of the public.

That's why we insist that any resurgence will have to be based on much safer plants.

Senator GRAHAM. Yes, Mr. Taylor.

Mr. TAYLOR. Mr. Chairman, I would like to add a thought to what has been said. One of the aspects of public confidence that has not been mentioned that I think is paramount is the safety of currently operating nuclear power plants, which is probably the number one mission of the people I work with. I think it is very important to the industry, and each and every utility operator that

the confidence of improved safety performance which we are seeing now, and NRC is publicly stating the improved performance based on many indications; this is very important for people to understand.

The confidence necessary for new plants, the aspects have been mentioned. Certainly, certainty in solid and good design and settling the issues early on to satisfy the uncertainties will rule the financial community participating. It is very important that we continue the course we are on, and which the Commission is on, which is to settle as many issues as possible early on, so that the license is not a matter of great contention at the time of the operational license. That's difficult to do. Some of the objections to that you have heard. But that is very, very important.

The other important aspect I think, is as you know, there are currently a number of designs that are lined up for certification. The Commission has a policy that a specific expression of interest, which is defined and has been published, by a utility in a particular design, would help move that design to the first priority on the part of the NRC, and I think on the part of DOE for whatever its participation might be.

So that element of an expressed interest would move that particular NRC review and attention to the top of the list. That means that we could put our best and strongest assets into the review in consonance with the utility and the vendor in completing a design certification and, potentially, construction.

Thank you.

Mr. PARLER. Mr. Chairman, I have a couple of thoughts that perhaps have not been mentioned.

It is clear to me that unless the two-step licensing process was revised that this would certainly have a considerable dampening effect on any orders after 1978 or at any time in the future. The Agency had tried for a considerable number of years to seek legislative relief in that area, and was not successful.

Therefore, about three years ago, the staff and the then- Chairman and Commissioners decided to proceed as far as the Agency could under its existing authority. That was the origin of what has now become Part 52, the so-called combined license, early site and design certification rule.

The rule has been challenged now. We will know more about it once the court speaks, but in my judgment, it rests on authority that we now have—it rests on sound authority. The rule will provide a considerable improvement in the process that we used for about 30 years to license over 110 nuclear powerplants.

The two-step process was successful in many cases, but in some cases it was not successful. Those latter cases are the ones that linger in the minds of the people that are here who urged the Commission to change its rules. Those thoughts linger just like the words in the regulation.

One of the things that has to be done is to move in the direction of Part 52. The other point relates to public confidence. I still believe very strongly that the process has to continue to be an open process with reasonable opportunities for public participation. The public certainly has to be adequately and fully advised about what is going on.

As for the rest, there has to be a continued approach to deal cooperatively and openly with responsible governmental officials, not only at the Federal level but also at the State level. We have programs that are designed to do that, and I think they are successful. That is something that I think is essential to continue in order to obtain and maintain public confidence, along with a strong regulatory and enforcement program.

If there is successful operation of these plants at a reasonable cost to the consumer, it seems to me that would go a long way towards dealing with the second two points you mentioned.

Mr. YOUNG. May I make just one point, Mr. Chairman?

I would like to express my support for Mr. Taylor's observation regarding the operation of nuclear plants. I think since Three Mile Island in 1979, the Institute of Nuclear Power Operations and the utility industry has made substantial strides, along with the NRC, in improving the disciplined operation and safety of nuclear power plants. Admiral Watkins, who has considerable experience in this regard, has stressed to the industry that this kind of operation must continue if we are to have a basis for further expansion of nuclear energy. I think that continued safe operation will be very important.

I also believe that at a time when decisions must be made regarding new plants that that kind of track record will be a strong basis for public consideration of the option.

Senator GRAHAM. Mr. Young, in your opening remarks, I got the sense that the word safety was being used at two different levels. One is safety for the specific plant that is currently under review. The second was safety as a process that involved the industry.

I am a private aviator. I learned to fly in an airplane called the Funk, made in Funk, Kansas. Fifty years ago, there were many, many aircraft manufacturers in the United States. I assume that each individual airplane had to meet some safety certification before it could be sold. But we found that for the totality of the aviation industry, the Nation was better served by having relatively fewer manufacturers concentrating on much fewer designed airplanes, each of which could incorporate experience and become safer as that particular design was multiplied. A 747 would be a prime example of that process of incorporation.

My question is, is your approach to safety the approach of the aviation industry of the 1930s, that as long as each individual plant meets its own specific standards of safety that that is the national policy, or is the aviation industry of the 1980s, that is going to try to concentrate on a relatively small number of designs incorporated within those latest units of design and past experience?

Mr. YOUNG. Our policy would be that of the 1980s, Senator. We are first of all supporting for certification four designs, and no more than that. Our rationale is that two of the designs are 1,300 megawatt plants, one of the pressurized water type, one of the a boiling water type, which have been the two technologies in this country that over 30 years have both proven themselves to be viable and desirable in the marketplace.

We are also supporting two designs of a 600 megawatt output, one pressurized water design, and one boiling water design. We believe this range of designs gives the utilities and others in this

country who might wish to be owners of nuclear powerplants a minimum number, but being able to choose the relative size depending on their system needs, and being able to choose a type depending on their basic background, experience and desires.

We think this is a number that provides both for competition and choice, as well as a minimum number to be standardized.

Within the question now of taking any one of those designs, a nuclear powerplant is a complex device. It has many features that are there principally for the purpose of maintaining the reactor in a safe condition, avoiding accidents with the reactor that might lead to undesired consequences.

It also contains many systems and aspects that are there simply for generating electricity. What we are saying is that for any given design, we would expect the NRC to certify those aspects of the design that are there to keep the reactor safe, and to make them very firm, such that they would not be changed, not have a multiplicity of designs.

Our thinking on the other features that are there for generating electricity principally is that the Nation would be served by standardizing those as well, not through the safety process, but through a process of developing the design to a point where it can be offered on a firm price basis.

We would envision that these designs that are standardized would be built on a repetitive basis, in each case, however, allowing for individual components within the plant to be furnished by suppliers on a competitive basis, again trying to keep the free market operation within the constraints of standardization.

Senator GRAHAM. We may be dealing with a semantic issue here of what constitutes diversity or similarity. Of the approximately 110 plants currently in operation in the United States, how many different designs would you, by your definition, say that those 110 plants represent?

Mr. YOUNG. Well, it's something less than 110, but not substantially less. What I'm saying is that if we were to build 110 plants, I am saying essentially we would have four designs if all four plants were to be used, as opposed to having 110 designs.

Senator GRAHAM. So using the standard of where we are today, you would see substantially fewer designs and iterations of those designs in the next era of U.S. nuclear power development?

Mr. YOUNG. Yes, sir. I think that's essential to make nuclear power viable.

Senator GRAHAM. In the testimony prepared and submitted by Mr. Taylor, there is a table on pages eight and nine that lists various designs that are under some state of review now, and there are approximately 12 or 13, it looks like, different designs on this page. Does this represent the universe that is contemplated, and if so, how does the 13 or so on these pages relate to the four that Mr. Young has just described?

Mr. TAYLOR. This lists all of the current designs that are even being contemplated that the Agency knows of. Some of them, such as PIUS, have not even yet been submitted for certification, although there has been an expression by the vendor-supplier that they would like to do that. It's the same with CANDU-3 and other reactors.

Mr. Young mentioned those that the Department of Energy is supporting. It is meant to be a complete list, and therefore I think it is a long list. I don't think any of us believe that all of these would ultimately proceed to certification. I think this list would shrink.

The Department of Energy is supporting, as they indicated, evolutionary type reactors and the advanced light-water reactors. They are supporting two evolutionary, that's the CE System 80 plus, and the ABWR, if I'm correct. The others are the two passive designs, the Westinghouse and the SBWR, the Simplified Boiling Water Reactor, which are both 600 megawatt plants.

Listed here also are the EPRI requirements documents which are not really plants. That's a utility effort to put together—and we are working on that, because it is very important to standardization and certification of plants. The EPRI Advanced Light-Water Requirements Document and the Passive Light Water Requirements Documents are the utilities' efforts to put together what they regard as the best features. They are more like a recipe to which a design would then be developed in detail. So they really are not plants, per se.

Some of these plants may indeed meet all of those requirements. So I have to delete the EPRI documents from the list. The bottom line is that I don't expect all of these plants to ultimately be certified.

You had asked about the degree of standardization. This involves the level of design detail, really this is the issue that is now being hotly debated by the Commission, because the issue becomes, if you do build an AP600, and you build numbers of them, how similar are the second, third and fourth units to the first? That's the issue. Are they going to be a great deal alike, with just site specific features different? That would be the ideal of standardization.

There are market forces that Mr. Young mentioned that sort of dictate some retreat from that in parts of the plant that may not have a direct influence on safety. It is that argument that is currently going on, and on which the Commission I expect will take a position very shortly. It's those kinds of issues in terms of following plants.

The closest I know of two plants that have been built, or at least a very good example of standardization, are the two so-called SNUPS plants, which are Calloway and Wolf Creek. They had the same constructor-designer.

Senator GRAHAM. What State is that in?

Mr. TAYLOR. Calloway is in Missouri, and Wolf Creek is in Kansas. Those were two later pressurized water reactors. The second plant learned a great deal from the first, a great deal. In fact there is a relationship that is still going on between those two utilities that is very close. It was a great benefit passed to Wolf Creek from the Calloway experience. So there is a miniature standardization situation.

Senator GRAHAM. Mr. Smith.

Mr. SMITH. May I add to Mr. Taylor's very good summary?

As he pointed out, EPRI proceedings are simply a review of what the utility industry, through EPRI, has put together as criteria for whichever of the designs is approved by the NRC. We think that

the requirements documents are the starting point for the review process.

In the testimony Mr. Bacher gave on behalf of EDF, he comments that even in France the units are not identical. I think it is likely, as one learns from the first how to make the second a little better or more economical, that those features should be incorporated into it.

But our industry desires very much to have what we consider to be a standardized plan that can be replicated. Certainly it is going to be a plant that meets with public confidence more easily. It is going to be a plant that can be built in a shorter period of time and more economically.

The two SNUPS plants that Mr. Taylor mentioned are a good example and also even on some systems where similar units have been constructed, there have been substantial savings in the State of Florida. The St. Lucie Unit No. 2 was completed in the fall of 1982, as I recall. It was very similar to Unit No. 1. That is standardization just of those two units.

On a much larger system, Commonwealth Edison operates 12 nuclear units. I believe their last two sets of pressurized water reactors at their Byron Station and their Breakwood Station, that those four units are all very similar, and they represent advancements over two earlier pressurized water reactors and design sections.

So I think we have experienced the benefit of some standardization, and we certainly have the desire and I believe the ability to achieve the economic and safety benefits of it.

Senator GRAHAM. Any other comments on this issue of safety and standardization?

Mr. BACHER. Perhaps I could give one additional piece of information, not so much comment on what really was standardized. We built three series. The 900 megawatts, three loops, PWRs, from 1970, the first one, to 1987, the commissioning of the last.

The second series, the 1,300 megawatt full PWR, the first order was in 1976, which is only six years after the first order of 900 megawatt units. We are still ordering 900 megawatt units afterwards. Our safety authorities accepted that we should have a standardized 900 megawatt series, that we should make changes for better safety in our new 900 megawatt units.

Again, we ordered the first N-4 unit, which is an advanced reactor by standards compared to ALWR or CE 80 Plus. It is the same category of reactors. Again, we ordered 1,300 megawatt units after the first N-4. For the next series we will certainly order the new advanced reactor, somewhere between 1995 and 2000, before we order the last N-4 series.

So they are always overlapping, but each series has a learning curve in safety also. The lapse of time between the first 900 megawatt series and the second 1,300 megawatt series was shorter than that between the 1,300 and 1,400 megawatt series, which again, will be a shorter lapse of time before the next series. This is because we feel we know more and more about the safety of those plants.

We think we can live longer with a different series. This may be the experience in this country also.

Senator GRAHAM. Mr. Bacher, another aspect of standardization is post-construction operation. Could you describe how the French system proceeds to try to standardize operations and to share increased operational and managerial experience across your 55 plants?

Mr. BACHER. Yes, of course it's not really relevant to this country. We have a single utility, central management.

Senator GRAHAM. That was the first of a two-part question. I wanted to find out what you do within your unified system, and then I wanted to ask how, in our decentralized system, if your level of operational standardization is a desirable goal, what are some of the steps we might take, given our different environment, our decentralized system, to accomplish that?

Mr. BACHER. I will try to answer this very difficult question in a few words. First of all, let's talk about hardware. We try to maintain stabilization over the whole life of the plants. I mentioned that we introduced a number of modifications in our 900 megawatt units after 1989. But we introduced those modifications on all the 900 megawatt units, identically.

Then operator training—we have the same operator training, we have national simulators, full-scale simulators, for our different series, and all the operating personnel go through the training centers, and go back every year for a few days to maintain training. Operations personnel move every few years from one unit to another so that the personal experience will be shared. That way, all the units will benefit from the experience of the best.

This is really what we are trying to do.

Senator GRAHAM. Mr. Young, Mr. Taylor—any other members of the panel—any comments as to the desirability of attempting to achieve some of those levels of standardization in training and management procedures within our system, and given its dissimilarities to the French system, what would you recommend we might do in order to accomplish that?

Mr. YOUNG. First, I think given the limited number of designs, we do already have in this country, both through the NRC and through INPO, standardization of training, operating practices and so on. There is a great deal of exchange among utilities. I think, as I said, there is a well-established practice for doing that. I think that would be simplified and enhanced by having to do it on a lesser number of plant designs.

Again, by limiting the number of plant designs you can standardize such things as operating procedures for the various systems that are very much alike. You can standardize to the extent that individual owners can make multiple buys of plants, you can standardize on things like components and spare parts.

I think these are the kinds of things that would be similar to what they are doing in France.

Senator GRAHAM. So you see the standardization of operation being a function of standardization of the design?

Mr. YOUNG. I think it flows from that. I am also saying I believe that even though we do not have just one utility in this country, we do have a very strong process through both INPO and NRC and the utilities themselves, of standardizing on practices, on training practices, and the many steps that are used in the operation of

plants already. I think this would be streamlined by having to deal with a lesser number of designs.

Mr. TAYLOR. I basically agree with that. There are differences in design which have to be reflected in the procedures at individual plants. However, there has been a great equalizing effect through the efforts of INPO and I think NRC. INPO, since TMI, has spent a great deal of time on training, and although there are many different plants out there, for the BWR types, all the commonalities are generally shared among the community.

The owners groups will also work on this type of thing, to share information. There is a great deal of that that has gone on in this last decade. So to the extent to which that goes on, it enhances safety. The differences that are there remain, and therefore the operators have to train on what we call a site specific simulator. We work very hard to insist that the simulator used for training reflect what is actually there at the plant.

Senator GRAHAM. It wouldn't do any good if it doesn't.

Mr. TAYLOR. That's right. And as plants change, the simulators have to be updated. There are many different features that have to be picked up that vary across the designs in each site simulator.

Ideally, the further standardization of equipment would lead to further standardization of procedures and emergency operating procedures, therefore making training easier.

Senator GRAHAM. Sherwood.

Mr. SMITH. Senator Graham, if I may add to that, our company operates a very early vintage pressurized water reactor that came in service in 1971, two somewhat later boiling water reactors that came in service in 1975 and 1977, and then a later pressurized water reactor that came into service in 1987.

We can attest to the value of standardization, because it is a challenge for our system to continually seek to have standardized approaches to similar operating conditions when you have those different types of units on a system. Our situation would be similar to many others in the country.

Through the collective efforts of the industry, and particularly with the leadership of the Institute of Nuclear Power Operations, even given the differences from unit to unit and from company to company, our industry has made great strides in achieving professionalism in the way in which we operate. This goes beyond simply being familiar with the specific piece of equipment.

We think we have made great strides in discipline, accountability, understanding on the part of every individual that is responsible for nuclear power, that they are entrusted with a very great responsibility.

Throughout our industry, through my own observation, I have seen tremendous strides forward with the leadership of INPO, and I would expect under a standardized system of plant that we would just accelerate the momentum that has already built up there.

Senator GRAHAM. The issue of the degree of design specificity that will be required in this movement towards standardization represents a bridge between standardization and licensure. Mr. Tousley commented about the fact that if you were going to have a truncated or a more expeditious licensing process, that puts a

greater premium on having all the information at the level of detail necessary available at the beginning of that process.

Could you discuss where we are in terms of resolving the question of how much detail will be necessary and what the effect of that will be on licensure reform?

Mr. YOUNG. Yes, sir. First of all, I believe the NRC staff has defined the kind of detail that would be required for them to have available to reach their safety decisions in a manner comparable to the way they have reached their decisions in the past to grant operating licenses. We have looked at their definitions of that level of detail.

We are cosponsoring designs by these four reactor manufacturers that I described earlier, and we believe that the level of detail that would be furnished in the applications that we are paying to develop early would meet and exceed the staff's need for information to make their safety decisions.

Mr. TAYLOR. In that regard, the staff has, and is proceeding in what we typically call the balance of plant, which is outside the specifics of the reactor block, to the engine room, feed condensate, control systems, and the issues that are being discussed are to what level of detail must those designs be complete. Is it just line diagrams, or is it indeed piping systems with stress analyses and supports?

So we are really dealing now in areas in which in the past the staff did not necessarily have to have in detail for making a specific safety decision for something that frequently got developed later. That is the discussion—how far to go. It is on that issue that the Commission is centering its attention currently. They will hopefully come up with a decision.

The staff is due, we aren't quite ready yet, we have heard from the Commission, from Mr. Young and many others, from the industry and others on this subject, and the staff is due within the next few weeks to go back to the Commission. We are working on that very actively.

I am not in a position today to tell you what it is, but we are working on it, and hopefully will go back with what we think is a position based on what everyone has had to say, then the Commission will rule on the matter. That will give us the basis. We certainly have had a lot of input.

Senator GRAHAM. Mr. Tousley.

Mr. TOUSLEY. We have read about some discussion on this subject where DOE indicated a concern that if too much design detail was required, it would not provide enough flexibility for competition among suppliers of equipment. We certainly would not have a design specifying a particular brand of valve or motor to be used, but we would have specified in considerable detail the specifications that the valves and motors have to satisfy.

I also want to point out that to the extent the detail is not in the certified design, then it is going to have to be fair game in the combined license proceedings that reference that certified design. If it has never been open to public scrutiny in the design certification rulemaking, then it will have to be in the combined license, and that will have to be a more detailed proceeding. It seems to me it is

in the interest of the industry to get the detail in as early as possible. That's the whole point of design certification.

Mr. YOUNG. May I comment on that, Senator?

That's precisely what we are addressing. While we do want to preserve the possibility for competitive procurement of individual valves or pumps or things like that, the whole purpose of the certification process and the information we are submitting is to pin down very exactly the performance requirements for those items of hardware such that whatever vendor's product might be installed in the plant, there would be no difference in the minimum performance that that piece of hardware had to provide to assure safety in the plant.

Further, I think that in offering information for certification, there is a very substantial completion that is being achieved in the aspects of the plant that are important to safety in terms of things like the reactor coolant system. We are going very far in terms of completing analyses defining specific locations of equipment and piping, and defining many of the details of the system necessary to assure that these performance requirements would be met. So we are very sensitive to specifying the level of detail that is necessary.

Senator GRAHAM. Mr. Smith, you commented on the fact that you have four separate designs. What was the background of having those four separate designs and what, if any, effect would a change in the licensure process have had or would have in the future on your decision as to redundant or different designs?

Mr. SMITH. The four units that we have—actually we have two units that have very similar designs—the two boiling water reactor units are located in one plant, our Brunswick plant. They are very similar in design. The reason we proceeded first of all as we did to order both the pressurized water technology and the boiling water technology was that as we enter the 1970s, we were the most rapidly growing utility in the country in terms of percentage growth.

We were growing at an average rate of slightly less than 12 percent a year from about 1968 through 1972. To serve the load we had, to continue to grow at that rate would have taken a large number of generating plants on our system. Coal would have been the other alternative fuel, so we had a large number of nuclear units and coal-fired units on our planning schedule in the early 1970s.

We felt it was desirable for us to learn how to utilize both technologies, both the boiling water technology and the pressurized water technology. The pressurized water technology generally is considered to be a technology which can step up and step down more rapidly. That enables you to follow your load. So at night when your load drops off, it would be easier to follow it by reducing power with the pressurized water reactors and bring them up earlier in the morning.

We found that licensing problems, licensing period, we simply were one of many companies that were caught in the whirlpool of the early application of the Environmental Policy Act. There were several events that occurred. There was a fire on a TVA unit, Browns Ferry, which substantially changed the way in which the NRC had regulated construction. Then of course there was the acci-

dent at TMI and more regulatory requirements were imposed upon us.

We did experience some delays in licensing of our last unit, and had we been in a position to have ordered a standardized unit and had that replicated our first unit, we could have shortened the licensing period significantly. But there were many factors all twirling and spinning around our industry from 1973 through the early 1980s that caused delays. But I think had we had a standardized procedure we could have substantially saved a lot of time on the last unit.

Senator GRAHAM. If the reforms that the NRC has recently initiated, standardization and licensing, go forward, do you anticipate during the 1990s that there will be a resurgence of orders from the industry for new nuclear plants?

Mr. SMITH. Senator, that certainly could be the case. There will be several things that will have to happen. The standardization and the shorter licensing period with certainty and no danger of a never ending public hearing—that's the key point. That's the linchpin.

Then the rate of growth in electrical consumption will have to continue at such a rate that we will need new large baseload plants. That's already taking place around the country in several areas. Northern Virginia, southern Florida and other places already see the need to order new baseload plants.

I think the State regulatory process will have to be such that the Commissioners themselves in Washington at the NRC see a process which leads to certainty with regard to what will be built and what length of time it will take to build it. If you know what you can build and how long it will take you to build it, then you can pretty accurately predict the cost.

If the State commissions, and I know Mr. Wilson was here earlier when these hearings began and testified on this, and I am not sure whether he addressed this specific question, but if State commissions see that the cost is predictable, they I think will be very likely to approve the utilities' decision to build improved plants.

I also think there will be risk sharing. I think the next nuclear plants that will be built, rather than being built by one single utility, are more likely to be built by a group of utilities or perhaps even a larger group that might include some of the manufacturers and vendors who would share some of the risk and benefit from the successful operation of the plant.

We have got to make progress on the disposal of our spent nuclear fuel, the high-level waste site. I would put equally at the top of my list, along with what we are discussing this morning, the need for the Department of Energy to be authorized to characterize the site at Yucca Mountain in Nevada.

I think it is a terrible thing for the electric consumers of this country to be held hostage by a system that prevents the national interests from at least doing a minimum amount of exploratory work to characterize a site. The State of Nevada issues permits to mining companies regularly that do much more excavation than would the Department of Energy, in its site characterization. I think that's essential.

There are other things we need to resolve, this question of whether or not States will have the authority to regulate emissions of radioactive nuclides. That's before Congress in the Air Toxics, title 3 of the Clean Air Act now. It would certainly be contrary to the whole principle of standardization if we decide that at the State levels, the regulation of radioactive nuclides, we would not standardize and potentially have 50 States authorizing different types of regulations for different types of facilities. These are some of the other things.

But it is my personal view that it is tremendously important in this country to be able to consider the nuclear option in the 1990s, if not with what is happening in the Middle East, we certainly will not be able to consider oil. We do have some natural gas, but we have gone through periods of tight supply before, and decisions on natural gas should have a primary use for residential heating consumption.

So we don't know how long the natural gas supply, what we used to call the bubble, is going to last. If we don't have the nuclear option the only thing we are going to be able to use is coal. Coal is important. We are making progress on the use of clean coal technologies. Fifty-five percent of our generation in this country probably comes from coal. But we have got to have another option. The only other option we have is nuclear power. As I said, nuclear energy gives American the power of independence.

Senator GRAHAM. Within the subjects we are discussing today, and as I indicated in my opening statement, we recognize that there are other issues that have got to be dealt with, such as the disposal question. Mr. Smith described the linchpin issue as being the hearing process, the finality prior to being granted permission to operate a constructed plant.

Mr. Tousley, you had some comments in your opening statement relative to that subject. What do you think are the necessary issues that should be reserved for a post-construction pre-operation public hearing? What are issues that can be handled by a post-construction, pre-operation administrative process, but without a full public hearing, and what are items that can be resolved before construction commences and essentially be closed, i.e., not open for further consideration prior to the grant of an operating permit?

Mr. TOUSLEY. Excellent question. We have heard about certainty in the licensing process from Mr. Smith and Mr. Young, particularly. I wonder what that means. What they seem to want is certainty that their plants would be able to operate without any further delay at the end of construction. I wonder how that could possibly happen.

How can the Commission do its job of insuring that this plant will operate safety, if there is not the possibility that it will decide at the end of construction that something might have happened during construction that requires them either to delay startup or prevent it?

If there is certainty in the licensing process, we may as well skip the licensing process. We agree that the overwhelming majority of issues should be decided prior to construction. All the siting issues certainly should be decided prior to construction, the design issues.

However, where we apparently part ways with the rest of the panel here is with the notion that you really can eliminate everything from post-construction proceedings. Some things come up during construction. It might develop that you hear from people who worked on the plant that certain materials used in it were counterfeit materials, they did not meet safety requirements.

There might be an accident at a plant of a similar design, which calls into question a fundamental component of the safety of that design. Certainly no one would argue that that should have no effect on whether the plant should go ahead and be licensed, but they are apparently arguing that that should not mean that the public gets an opportunity to participate in the resolution of those issues before the plant goes into operation. I believe that's a serious mistake.

The bottom line is, unless something happens, new information comes up or developments occur during construction to call into question either the design or the license that was granted, or whether the plant satisfies its license, we agree that there is no reason to relitigate issues prior to operation.

But when there is new information or developments, we need the opportunity to show that some aspects of the basis on which this plant was licensed are no longer correct. Then the public should have the same opportunity for a hearing before operation that they have under the old system. In fact, we believe that the Atomic Energy Act requires that. It should not be necessary to raise issues as show cause proceedings. The standards for those are just impossible. The Commission has apparently not granted one in about 10 years, in the sense that they have said "Yes, you can have a hearing on this subject."

There is no review of that decision, apparently, they say it is not reviewable in court, and several courts have agreed with them. That is not satisfying the Atomic Energy Act requirement for a hearing before the Commission issues a license. So we think when the public comes up with good reasons why there should be hearings before operation that there should be hearings before operation.

There is no need for those to be wasteful, because the Commission has all sorts of authority and exercises it regularly to throw out stupid contentions. They don't need a law saying there will be no hearings after construction. They have the authority to take care of frivolous claims now, and they do it all the time. Hearings take a long time when there are real issues involved that are not easy for the Commission to dispose of. We feel that should continue.

Senator GRAHAM. So is it your position that the status quo prior to the recent NRC change in regulations was the appropriate relationship between pre-construction, post-construction, public hearing versus administrative determination?

Mr. TOUSLEY. No, it isn't.

Senator GRAHAM. If you could rewrite NRC rules, including rewriting the law itself, if that were a constraint, how would you recommend the process be handled?

Mr. TOUSLEY. Well, they would probably find it surprising to find that it would look a lot more like the new process than the old one.

The old process let way too much be delayed until the operating license proceeding. Issues of emergency planning were delayed until the operating license proceedings for Seabrook and Shoreham. That is the primary reason those plants took so long to license. That's crazy. Those issues could have been completely resolved in operating license proceedings, and we think they would have been cancelled as a result of that consideration.

Having a lot more issues resolved a lot earlier, we agree with completely.

Senator GRAHAM. Did you say they would have been resolved in an operating license hearing?

Mr. TOUSLEY. The emergency planning issue should have been resolved in the construction permit proceedings prior to construction. Those are entirely siting issues which do not have much to do with the design of the plant. That's why they should have been considered. Intervenors in those construction permit hearings tried to raise those issues at that time, and were told they could not, that the appropriate time to deal with that was at the operating license hearing. Of course, at that point, billions of dollars had been spent and it was very hard to have a fair consideration of those issues under those circumstances.

The primary difference we have between the rule the Commission passed and what we think it should be is, that rather than say the only issues considered at the end of construction are whether the acceptance criteria have been met, we should be able to consider whether the requirements of the Atomic Energy Act have been met, and whether the Commission's regulations have been met.

The overwhelming majority of those issues should have been decided before, so they will not be subject to relitigation at the end. When the public comes up with real problems and real new issues that developed there, then there should be hearings just like there were under the old system.

Mr. PARLER. Mr. Chairman, as I mentioned earlier, there is a difference of opinion between the petitioners who are challenging the rule in the federal courts and the Government. The briefs in the case have been filed, and oral argument will be held on September 26 of this year.

In my judgment the approach that is taken in Part 52, as I have already said, is in accord with our authority. Both issues that have been raised here today, the authority to combine in one license the license that is required to construct as well as the authorization to operate, and also the opportunities for public participation in our judgment, are in accord with the hearing rights afforded under section 189 of the Atomic Energy Act.

Basically, there is a balance, there is a tradeoff, in Part 52. On the one hand, as you were discussing earlier, if the requisite information, the design information as well as the siting information is provided early on, prior to the time construction commences, and if the Agency reviews and approves it, the quid pro quo is finality unless there is subsequent information which indicates that there is some significant safety issue or something that is needed to provide adequate protection to the health and safety of the public.

At the time the combined construction and authorization and operating license is issued, the license would have in it the accept-

ance criteria. If these acceptance criteria are satisfied, then that should provide the reasonable assurance that the plant has been constructed in accordance with the application and there is reasonable assurance that it will operate in accordance with the applicable Commission regulations and requirements.

If there is some challenge to the compliance with the acceptance criteria, we would follow, at the Commission level, a fairly structured approach to decide whether the problem that is identified should be fixed. Only after we go through all of that will we come to the point of whether or not we have to have a hearing to resolve some factual dispute.

The regulations also provide that if the acceptance criteria have to be modified after the combined license is issued, there will be an opportunity for the public to request a hearing on the modification of the acceptance criteria. So it is not a question of certainty to the extent of eliminating the opportunity for public participation.

The structure of the rule is to provide the opportunity for public participation at an earlier stage prior to the time the construction starts, so that you will not have the situation which occurred at least a couple of plants where they had been either completely or substantially constructed and then persons whose interests may be affected started arguing about whether the plants should have been built at particular sites. Part 52 rejects that approach.

The issues that have been raised here by Mr. Tousley are before the U.S. Court of Appeals. I am confident that a proper and just decision will eventually be rendered, and we will comply with it.

Senator GRAHAM. Any other comments on that subject?

Mr. TOUSLEY. Briefly, the limitation of a post-construction proceeding to whether the acceptance criteria have been met is not acceptable to us, because we don't believe that they can come up with acceptance criteria that incorporate everything that has to be considered by the Commission in making its safety findings.

In the first place, we think that is a problem because those acceptance criteria are going to be suggested in the first instance by the vendors of the designs who don't really have much incentive to put forth rigorous standards that they have to meet for themselves.

Also, because the Commission cannot know before construction everything that might happen during construction. They cannot posit a test or an inspection or an analysis that covers everything. When something comes up that is not covered by those, that's when we think we need to be able to discuss that, too. So they are making too narrow the possible things that can be litigated afterwards.

He mentioned that you can also challenge the acceptance criteria. But as I pointed out, that can only be done through a show cause proceeding, which has an extremely high standard, the Commission never grants them, and courts won't review them.

Mr. PARLER. I have to add something. If acceptance criteria or anything else are challenged in what we call Section 206 petitions, our procedures do require the responsible office director to issue a decision. So at least the petitioner knows what the position of the office director is. If the Commission itself wants to step in and review that decision, it has the discretion to do that.

It is correct that several courts of appeals have said they will not judicially review, at least up to this point, such decisions. But it would not be astounding to me that if such a decision were irrational or completely off target, ignoring some obvious safety issue, that there would be a potential for judicial review.

Senator GRAHAM. You're not suggesting that the NRC would have a proclivity for such irrationality or oversight?

Mr. PARLER. Not at all, sir.

Mr. TAYLOR. Not if we are here, sir.

Senator GRAHAM. Let me ask a final question, that is, I think, probably at the heart of the litigation that Mr. Parler just referred to. That is the degree to which the NRC, under its current statute has the authority to take the initiatives that it has taken, both in standardization and in licensure reform, and the degree to which it either is necessary or for purposes of stability and predictability, would be desirable to have the underlying law changed. I think Mr. Smith, on one or more of those issues, indicated he felt a law change would be desirable.

Mr. TAYLOR. The Commission has looked at this, and thus far it does not see a need for such legislation, thinking that the process we have underway, that which is already set in place, will accomplish what needs to be done. That could change. I will ask Mr. Parler if he wants to add anything to that.

Mr. PARLER. I certainly agree with that position, Mr. Chairman. I recommended it to the Commission. Bear in mind that we are talking about a rather substantial change in the procedures, based on some 35 years of experience under the earlier system. We have not yet reached agreement on certain things that have been discussed here, such as what constitutes an essentially complete design, and it is obvious we have yet to approve our first certified design or issue our first combined license.

I am aware of the argument that folks have been making that unless the NRC does certain things, which seem to center around the limited opportunity for a hearing prior to operation, Part 52 may not ever be used because no utility is going to file an application.

Nevertheless, my judgment is that Part 52 rests on solid legal grounds, and no additional authority is needed at this time to augment its statutory foundation. If this judicial matter, which I have referred to earlier, and which is going to be heard on September 26, is adverse, which I don't think it will be, well then, that will be another matter which the agency can discuss later. But I am optimistic that the rule will be sustained.

Senator GRAHAM. Any other comment on that question? Mr. Young.

Mr. YOUNG. Yes, sir. The Department of Energy has also addressed this question and in a letter to the NRC of November 7, 1988, it pointed out that we agree there is existing authority for the 10 C.F.R. Part 52 provisions.

Senator GRAHAM. Mr. Tousley.

Mr. TOUSLEY. Well, needless to say, we think it would be very unwise for Congress to undertake legislation that would eliminate pre-operation hearings, as a matter of policy.

Senator GRAHAM. Any other comments? Mr. Smith.

Mr. SMITH. Senator Graham, with all due respect to the significant work that has gone into the rule that the NRC has published, I think it is a great step forward, and it certainly minimizes the risk of lengthy adjudicatory hearings at the end of the construction period, and I take in complete good faith the statements that Mr. Tousley made, that he does not see any desire on the part of some people simply to frustrate the process.

There are other people in this country, for whom none of us here can speak, who may have different views. As Senator Simpson said earlier, their dedicated opposition to nuclear powerplants or powerplants of any kind may lend them to take advantage of an opportunity that was not intended to obstruct the process.

While the risk of a hearing might be very small, the adverse impact and high cost of such possibility of a lengthy hearing which might be determined by one judge or three judges, we don't even know who they are or what the issues would be, that is so great.

That is such a threat and deterrent to utilities that have already suffered billions of dollars of prudence disallowance. It is a threat that is perceived by State regulatory commissioners and by the financial community, that we do have a genuine concern that the matter cannot be safely and finally put to rest without legislation.

Mr. PARLER. Mr. Chairman, on the point about who will decide whether or not there will be such a hearing, I would like to point out that the rule provides the discretion of that judge will be exercised by the Nuclear Regulatory Commissioners. That is a majority of the quorum of the five people that are appointed and confirmed to head that agency, not to any isolated administrative law judge or hearing examiner.

Senator GRAHAM. Gentlemen, I appreciate very much your contribution to our understanding of the issues. This has been an extremely informative panel.

As I indicated, on October 2, we will complete this series of three hearings with a discussion on the disposal issue, which as several have commented is another key component of the state of health of the nuclear patient.

I want to particularly thank Mr. Bacher for the great effort he expended. I ask if he would extend our best wishes to Mr. Carle and our hopes for a speedy recovery. Our two nations have had a long and very positive relationship. My own State of Florida for a brief period of time in the 1560s was a colony of France, a piece of our history we very much appreciate and have benefitted from.

We thank you for the contribution you have made today. I hope we will be able to learn from your experience and together build a stronger, more energy independent nation for our citizens to live in.

Mr. BACHER. Thank you, Mr. Chairman. May I say that we based our nuclear program on the U.S. experience.

Senator GRAHAM. Thank you very much. The meeting is adjourned.

[Whereupon, at 11:57 a.m., the subcommittee was adjourned, to reconvene on Tuesday, October 2, 1990.]

Statement of William H. Young

Assistant Secretary for Nuclear Energy

Before the

Subcommittee on Nuclear Regulation

Committee on Environment and Public Works

United States Senate

September 18, 1990

Good morning, Mr. Chairman and members of the Subcommittee. I am pleased to have this opportunity to present the Department of Energy's views on commercial nuclear powerplant standardization and licensing.

Nuclear power is a key element of the Nation's energy base; it supplies about 20 percent of our electricity, our second largest source. While forecasts differ in their projections, it appears that utilities will require over 250 gigawatts of new capacity in the next 20 years. Based on historical trends, about 80 percent of this capacity must be baseload generation. Nuclear power can provide a substantial portion of this new capacity and help ensure a reliable supply of electricity while providing supply diversification. An order would have to occur by the mid-1990s to have a new nuclear plant -- most likely an Advanced Light Water Reactor (ALWR) plant -- operating by 2000 or shortly thereafter. Orders would have to continue through the late 1990s to permit nuclear power to make a significant contribution to the baseload electrical generating capacity that will need to be added in the post-2000 period. The Department's ALWR programs are designed to provide the free market a choice of viable new nuclear powerplant options in that time frame.

Standardization

The Department believes that standardization of new nuclear powerplant designs is an essential element of the future nuclear power program in the United States, to avoid the multiplicity of designs that characterized past experience. At the same time, standardization must be structured so as to enable competition and free-market forces to operate.

Standardization will contribute to the viability of nuclear power by improving the safety, reliability, and economy of nuclear energy. A number of

safety benefits will occur as a result of plant standardization. Standardization of safety systems will assure that the plant behavior is well understood. Components and systems will be less susceptible to uncertainties and pitfalls associated with design changes. It will be possible to share operating experiences from plant-to-plant, and training will be relevant when an operator transfers from one plant to another. Standardization will improve the reliability of nuclear power by designing quality plants that would minimize the unplanned shutdowns that adversely impact the availability of plants. Finally, standardization should improve the economics of nuclear energy by minimizing the need for individual licensing reviews and approvals for each plant, thereby reducing and providing certainty for the time required for the licensing process. Standardization will also assure economic viability and financial certainty by first fixing a standard design that can be a basis for firm cost estimates and construction schedules, and next providing for construction of replicate plants with provision for competitive procurement of components and materials.

Differences Between Safety Certification and Commercial Standardization

The Department sees standardization occurring in two successive and distinctly different steps. The first step is design certification by the Nuclear Regulatory Commission (NRC) on the basis of safety considerations, which will provide for standardization of plant safety functions. The second step is commercial standardization for economic and other reasons, which would be carried out by the Department and industry.

The Department views commercial standardization as a process apart from -- and beyond -- NRC plant safety certification. We believe the NRC regulatory

process should be the vehicle for assuring standardization only to the level necessary to assure safety and should not be the vehicle for attempting to achieve standardization for economic and other purposes. NRC's regulations and licensing reviews should not over specify details that would limit competition, unduly complicate the regulatory process, or stifle appropriate technological advance.

DOE has approached design certification with free-market principles in two ways. First, four designs -- evolutionary 1300 megawatt pressurized and boiling water reactors and passive 600 megawatt pressurized and boiling water reactors -- are being sponsored by DOE for NRC certification. Second, standardization of the individual designs, with provisions for competitive procurement of equipment and materials, is the basis for the certification we are proposing. Further, all four designs will meet utility standardization requirements reflected in the Electric Power Research Institute (EPRI) Requirements Documents. We believe this approach provides for the construction of only a limited number of certified standardized plants while still permitting adequate free-market competition.

The Department has four contracts with reactor manufacturers to demonstrate use of the process specified in the new NRC rule to improve the licensing process (10 CFR Part 52), obtain ALWR design certification, and develop that level of detail necessary to satisfy NRC safety requirements. These contracts include General Electric's Advanced Boiling Water Reactor scheduled for design certification in 1992, Combustion Engineering's System 80+ design scheduled for certification in 1993, and two passive ALWR designs by General Electric and Westinghouse, for which certification is scheduled by 1995. These schedules are currently under review by the NRC.

There has been considerable discussion over the past several months regarding the level of design detail required by the NRC to permit safety certification. The Department expressed its views on that subject most recently in an August 31, 1990 letter to the NRC, which is submitted for the record. In that letter, the Department pointed out that the level of design detail necessary to permit NRC safety decisions to be made and designs to be certified will be available for submittal by the reactor manufacturers under the contracts just described. We hope to resolve design certification questions with the NRC on that basis.

The Department is presently in the process of establishing approaches to achieve commercial standardization. Working with industry, DOE is defining the level of design detail that could provide commercial standardization for the ALWR. The definition is in terms of the additional design detail that would be developed beyond the detail required for safety certification. Consistent with the approach to standardization that provides for competitive procurement of equipment and material, the extent of completion of the design of an ALWR plant is being defined in such a way that is independent of prior orders for, or construction of, such a design. Completion of an ALWR design up to the point of commercial standardization should establish whether utility industry cost, schedule, and reliability targets, as specified in the EPRI Requirements Documents, will be met.

The Department is also considering support of first-of-a-kind engineering and design efforts to provide for commercial standardization. Both the House and Senate Appropriation Committees, in their actions on the FY 1991 Department budget, urged consideration of Federal funding of first-of-a-kind engineering

starting in FY 1992. We will inform Congress of our recommendations in this regard, after receiving Administration clearance, in our FY 1992 budget submission. We will also consider some forms of economic incentives or mechanisms for assuring that plants constructed are standardized.

Early Site Approval Program

10 CFR Part 52 lists the NRC requirements for a utility or other party to obtain preapproval of a site. The Department is planning a demonstration of this process and to that end recently issued a Request for Proposals and is awaiting responses. We hope to select at least one participant and award a contract during FY 1991. The program is designed to result in the award of at least one early site permit by the end of 1994. This date is consistent with the schedule for other aspects of the ALWR program and necessary to meet the need for new plant orders by the mid-1990s. The Early Site Approval Program, coupled with certified designs, would demonstrate considerable improvement in the stability and predictability of the licensing process.

Need for Legislation

By working closely with the utility industry and the NRC in defining a comprehensive and proactive approach to design certification and commercial standardization as I have outlined, the Department will fulfill its proper leadership role. We are still examining the possible need for legislation to promote commercial standardization. We will be better able to determine the need for legislation as we define our program for commercial standardization and our budget proposals for FY 1992. We believe very strongly that plant

standardization is an important element of the future viability of nuclear power.

Licensing Reform

During the course of collecting the information from which the National Energy Strategy (NES) will be developed, the nuclear licensing process was identified as a factor likely to diminish the future expansion of nuclear energy use in the United States. The Department of Energy's Posture Statement and Fiscal Year 1991 Budget Overview addressed legislative priorities for improving the prospects for safe use of nuclear power to help meet our future energy needs through nuclear licensing reform, including appropriate legislation. The Department is ready and eager to work with the NRC and Congress to ensure that the necessary additional reforms are made expeditiously consistent with the protection of public health and safety.

Notwithstanding the technical soundness and extraordinary safe operating record of nuclear powerplants in the United States, the utility industry and the financial community are reluctant to risk investment in nuclear power unless they can have reasonable assurance that a plant can be operated without undue delay when it is ready for operation. The NRC took a major step forward when it issued 10 CFR Part 52 and identified the criteria necessary to achieve design safety certification. However, the NRC has acknowledged to Congress that its rule does not address or improve certain aspects of emergency planning. It also does not eliminate the possibility of lengthy procedural delays when a plant is ready for operation. The post-construction hearing process has repeatedly been identified as a most important aspect requiring meaningful reform. Essentially completed and operational plants must be

permitted to initiate power production and not be delayed until a lengthy and unbounded hearing and appeal process is completed.

In developing the NES, we will be addressing the issue of a fully satisfactory regulatory process. Consideration will be given to legislation addressing codification of the NRC rule, limiting the potential of the second hearing, and dealing with emergency planning - related impediments to new powerplant orders. A decision on the need for this legislation will be made after the NES process has been completed.

Concluding Remarks

I thank you for this opportunity to present the Department's views. I would be pleased to answer your questions.

PREPARED TESTIMONY

SUBMITTED BY

UNITED STATES NUCLEAR REGULATORY COMMISSION

TO

SUBCOMMITTEE ON NUCLEAR REGULATION

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

UNITED STATES SENATE

CONCERNING

STANDARDIZATION AND

THE LICENSING PROCESS

PRESENTED BY

JAMES M. TAYLOR

EXECUTIVE DIRECTOR FOR OPERATIONS

SUBMITTED: September 18, 1990

Thank you Mr. Chairman. I am pleased to appear before you and the Subcommittee today to report on the Nuclear Regulatory Commission's (NRC) activities related to the standardization of new reactor designs and the licensing process for nuclear power plants. Mr. William C. Parler, the Commission's General Counsel, and other members of the NRC staff involved in this work are also here today.

As the Subcommittee knows, the NRC has for some time encouraged the concept of standardized nuclear power plants. Most recently, in April 1989, the Commission promulgated its standardization and licensing reform rule 10 CFR Part 52. A number of NRC review activities related to standardization under Part 52 are taking place. I will attempt to address the subjects you raised in your letter of September 6, 1990, starting with standardization. I will then discuss the status of ongoing reviews of specific standardized reactor designs.

Design Standardization

The NRC has long sought nuclear power plant standardization because of the safety benefit which standardization is expected to bring. In the Fall of 1987, the Commission issued a policy statement encouraging nuclear power plant standardization. In part, this policy set forth the fundamental safety judgment underlying the licensing reform and streamlining initiatives carried out by 10 CFR Part 52 which is:

> "The Commission believes...standardized designs can benefit the public health and safety by concentrating resources on specific

> design approaches without stifling ingenuity; by stimulating standardized programs of construction practice, quality assurance and personnel training; and by fostering more effective maintenance and improved operation. Standardization should result in significant economies of scale in learning and sharing operating experience, in maintaining qualified vendor support, and in maintaining an adequate inventory of long lead-time, high-cost spare parts... Standardization will allow for a more expeditious and efficient review process and a more thorough understanding of the designs by the industry and the NRC staff."

The Commission finds a direct relationship between safety and design standardization, and also believes that a high level of design detail at the design certification stage will minimize diversity among individual plants which reference a certified design. Among other things, excessive diversity among a class of plants can increase the complexity of maintenance, increase the potential for human error, and affect the availability of spare components.

Safety benefits associated with such standardization are expected to include quicker and more thorough feedback of construction and operating experience, improved maintenance resulting in more reliable equipment, and more uniform training of operating staffs. Cost advantages expected from standardization include shorter construction times - resulting from experience feedback, reduced design costs - due to the referencing of the same design for multiple plants, and fewer costly changes during construction - because of the fixed certified design. Once operating, these plants should be more reliable and economical because of increased experience, knowledge and understanding of

problems which cause shut-downs. The combination of these factors, particularly the safety benefits associated with standardized designs, make standardization an attractive licensing option.

However, some policy issues regarding standardization are still under consideration. One such policy issue now before the Commission involves the level of design detail necessary for a design certification under Part 52. In its consideration of this issue, the Commission has met with both the NRC staff and representatives of the nuclear industry to obtain recommendations for establishing an appropriate level of design detail. Recently, the Commission published in the Federal Register a request for comment on a report prepared by the staff on the level of detail required for design certification under Part 52. The report identified various levels of design detail that could be required, and the advantages and disadvantages of each. Comments have been received and are being evaluated by the Commission. The Commission also understands that the nuclear industry's Nuclear Power Oversight Committee is developing a plan to promote standardization, and that this plan will be submitted to the Commission this October. After considering all of the information relevant to this issue, the Commission expects to reach a decision on the required level of design detail this fall. This decision may require the vendors to perform more work to complete their applications for design certification and, therefore, could affect schedules. After the Commission decision on this issue, the Commission will reevaluate the schedules and resources for design certification activities and will forward the schedules and resource information to the Committee.

The Licensing Process

Now I would like to discuss some aspects of the licensing process. The construction and licensing of the current customized designs under the existing two-step licensing process has proven, in many cases, to be inordinately time consuming. Because, in the two-step process, plant construction typically began before plant design was completed, many safety questions were not finally resolved until the operating license proceeding for that plant. This delayed resolution of some safety questions and introduced great uncertainty into proceedings, because the process of resolution often entailed lengthy safety reviews, construction delays, and backfits. Additionally, the low incidence of duplication among designs has meant that experience gained in the construction and operation of a given plant may not have been transferred to the construction and operation of any other plant, and has made the generic resolution of safety issues more complicated. This has resulted in a relatively large commitment of resources for the processes of design, construction and licensing review. It is apparent that the two-step licensing process and lack of standardization contributed to the cost overruns and delays that plagued many of the plants under construction in the 1970's and 1980's. However, poor utility management and construction practices, the failure of some states and local communities to develop offsite emergency plans, reduced need for power in some communities, and high interest rates were significant contributors to extended schedules and cost overruns.

Recognizing that its licensing regulations could be improved, the Commission issued 10 CFR Part 52, the NRC's standardization and licensing reform rule, to

address process problems identified by past experience. The principal objectives of the new rule are a more efficient licensing process and the safety enhancements which are expected to result from standardized nuclear power plant designs. To these ends, the regulation facilitates the early resolution of safety issues by providing for Commission certification of standardized designs, pre-construction-permit approval of power plant sites, and the issuance of licenses that combine permission to construct a plant with permission to operate it once construction has been successfully completed. The rule also allows for the issuance of Preliminary and Final Design Approvals (PDAs and FDAs) based on favorable NRC staff reviews. A staff-issued FDA is required for all applicants as a prerequisite to receiving Commission design certification. Each of these licensing steps requires that safety issues, which in the past were sometimes resolved late in the process, be addressed at an early stage. The rule permits certified designs and separately-issued early site permits to be "banked" and subsequently referenced in an application for a combined license.

Additionally, it should be noted that the rule does not reduce the scope of safety issues previously considered, nor the public's ability to participate in the regulatory process. It simply moves consideration of the bulk of safety issues to an earlier stage in the licensing process. For example, separate proceedings applicable to the issuance of an early site permit and a design certification could be completed in advance of the submission of an application for a combined license to construct and operate a facility. Accordingly, for an applicant of a combined operating license who references a certified design and an early site permit, most safety issues would be decided before submittal of the license application.

Review Status

We consider future reactor designs to fall into three categories: evolutionary light-water reactors (LWRs), advanced passive LWRs, and advanced non-LWR designs. The specific designs that we are reviewing, or anticipate reviewing, in each of these three categories are identified in the attached table. These designs are standard plant designs which we generally expect will have design certification as their ultimate objective. In addition to the specific designs being reviewed, the Commission is or will be carrying out reviews of the Evolutionary LWR and Advanced Passive LWR Utility Requirements Documents being prepared by the Electric Power Research Institute (EPRI).

For the evolutionary LWRs, our technical reviews are in progress and were previously scheduled to be completed in the 1990-1992 time frame. We had planned to complete our review of Evolutionary LWR Utility Requirements Document in 1991 and the Advanced Passive LWR Utility Requirements Document in 1992. For the advanced non-LWRs, most of the technical reviews of the conceptual designs, including review by the Advisory Committee on Reactor Safeguards (ACRS) and the issuance of our draft safety evaluation reports (SERs) for the modular high temperature gas-cooled reactor (MHTGR) and power reactor inherently safe module (PRISM) have been completed. Final preapplication SERs will not be issued until we have received further clarification from the Department of Energy on the direction of the MHTGR and PRISM programs.

To facilitate the certification of standard plant designs, the Commission is focusing its attention on the policy issues that are being identified as the

first evolutionary LWR designs are being reviewed. The Commission is also focusing its attention on the 600 MWe advanced passive LWR designs, which are the next class of plant for which the Commission expects to receive requests for certification under 10 CFR Part 52. Although agency review of key policy matters may affect the schedules of these first designs, the Commission believes that certification under Part 52 can be effectively implemented only if key policy matters are considered by the Commission early in the review process, or as in the case of the passive and non-LWR plant designs, before the actual certification reviews begin. As stated earlier, the Commission will reevaluate the review schedules after deciding the key policy issue of level of design detail.

The Commission believes its ongoing activities will successfully resolve the pending certification issues. Also, its current regulations (10 CFR Part 52) provide an adequate and workable mechanism for future licensing of nuclear power plants. Therefore, the Commission believes that legislative changes are not needed at this time. Although the Commission is not recommending enactment of legislation, the Commission is reviewing various aspects of its licensing requirements to assure compatibility with the principle underlying Part 52 that safety issues be resolved early. For example, the Commission is examining its emergency planning regulations, particularly the role of emergency planning exercises, and whether the Commission's siting regulations should be revised to clearly differentiate between siting and design considerations. The Commission will make any necessary changes to its regulations after it completes its review. The ultimate objective is to focus potential hearings after the issuance of the combined license on matters such as whether the plant was constructed in conformity with the combined license.

Table - Future Reactor Designs

Reactor	Lead Industry Developer	Power Level, MWe	Requested Review
Evolutionary Light-Water Reactors (LWRs)			
Advanced LWR Requirements Document	Electric Power Research Institute	-	SER
Advanced Boiling Water Reactor (ABWR)	General Electric	1300	FDA Certification
Standard Plant for the '90s (SP/90)	Westinghouse	1300	PDA
System 80 Plus	Combustion Engineering	1300	FDA Certification
Advanced Passive LWRs			
Passive LWR Requirements Document	Electric Power Research Institute	-	SER
Advanced Passive (AP600)	Westinghouse	600	Preapplication review
Process Inherent Ultimate Safety (PIUS)	ASEA Brown Boveri	600	Preapplication review
Simplified Boiling - Water Reactor (SBWR)	General Electric	600	No review request
Safe Integral Reactor (SIR)	Combustion Engineering	300	No review request

PDA - Preliminary Design Approval
FDA - Final Design Approval
SER - Safety Evaluation Report

Advanced Non-LWR Designs	Lead Industry Developer	Power Level, Mwe	Requested Review
Modular High-Temperature Gas-Cooled Reactor (MHTGR)	General Atomics	540 (4 units)	Preapplication SER
Power Reactor Inherently Safe Module (PRISM)	General Electric	1395 (9 units)	Preapplication SER
Sodium Advanced Fast Reactor (SAFR)	Rockwell International	1400 (4 units)	Preapplication SER*
CANDU-3 Pressurized Heavy-Water Reactor	Atomic Energy of Canada Limited	450	No application for Certification received

* - DOE has eliminated funding. NRC to complete preapplication SER at DOE's request.

STATEMENT OF MR. SHERWOOD H. SMITH, JR.

CHAIRMAN, PRESIDENT AND CHIEF EXECUTIVE OFFICER

CAROLINA POWER & LIGHT COMPANY

ON BEHALF OF

THE AMERICAN NUCLEAR ENERGY COUNCIL

AND

THE EDISON ELECTRIC INSTITUTE

BEFORE THE

UNITED STATES SENATE

SUBCOMMITTEE ON NUCLEAR REGULATION

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

"STANDARDIZATION OF DESIGNS AND THE LICENSING

PROCESS FOR NUCLEAR POWER PLANTS"

SEPTEMBER 18, 1990

Mr. Chairman, members of the Subcommittee, I am pleased to present the views of the nuclear energy industry on the importance of standardization and licensing reform and the need for the industry, the Administration, and the Congress to work effectively to overcome obstacles to nuclear energy development.

I am Sherwood Smith, Chairman, President, and Chief Executive Officer of Carolina Power & Light Company. My company was the first to have a commercial nuclear energy plant in the Southeast, and operates four nuclear plants in North and South Carolina. I am currently Chairman of the Nuclear Power Oversight Committee, and have served as chairman of the American Nuclear Energy Council and the Edison Electric Institute. Over the years, I have also participated on the boards of the Institute of Nuclear Power Operations, Electric Power Research Institute, American Nuclear Society, and U.S. Council for Energy Awareness. Through this experience, I have personally witnessed the disastrous effects that can be caused by delays in the planning, design, licensing and construction of nuclear energy plants.

My statement is presented on behalf of the American Nuclear Energy Council (ANEC) and the Edison Electric Institute (EEI). ANEC represents over 100 companies with an interest in nuclear energy, including investor-, public-, and cooperatively-owned nuclear utilities, manufacturers, architect-engineers, nuclear waste management firms, and firms otherwise engaged in the nuclear fuel cycle. EEI is the national association of investor-owned electric companies, whose members generate and distribute about three-quarters of the nation's electricity.

I understand this is the second of three hearings that the Subcommittee plans on major questions related to continued development of nuclear energy. The importance of Congressional attention to standardization and licensing reform was made plain at the previous Subcommittee hearing. At that hearing, DOE Deputy Under Secretary for Policy, Planning and Analysis Linda Stuntz pointed out that without continued nuclear energy development, the use of nuclear energy to generate electricity may disappear by the year 2030. Since one of the main obstacles cited by both Ms. Stuntz and the other witnesses to continued development was the licensing process, it is appropriate that the Subcommittee address this issue. Significantly, DOE projects that nuclear energy can account for 27 percent of U.S. electric generation in 2030 if the obstacles confronting continued development are overcome.

Currently, nuclear energy is supplying about 20 percent of the electric needs of the United States. The 112 nuclear plants operating in our country represent the world's largest commitment to nuclear energy, and generate more electricity than the plants

in France and Japan combined. Overall performance of U.S. nuclear plants improved in 1989, and nine were among the world's 25 most reliable nuclear plants. Indeed, one U.S. plant, Three Mile Island 1, led the world in terms of performance last year, with a capacity factor of 100 percent. The solid record of performance of U.S. plants proves that nuclear energy is one of the pillars of domestic energy production. In this light, license renewal is needed to maintain reliable electric supplies.

The electric utility industry wants -- and needs -- to be able to include nuclear energy in its planning for new baseload capacity. Electric consumers -- for economic and environmental reasons -- need this option. Specifically, our industry would like to be able to order and begin construction of new nuclear plants within the next several years so they can be operating at the turn of the century. We want to be able to place a new order in the mid-1990's in order to meet demand. To do this, several critical issues need be resolved, including certification and licensing reform issues in the early-1990's.

In his address to a joint session of Congress last week, President Bush pointed out the cost of reliance on imported energy: "There's an energy-related cost to be borne as well... We must then take advantage of our energy sources across the board: coal, natural gas, hydro and nuclear. Our failure, our failure to do these things has made us more dependent on foreign oil than ever before..." President Bush called on the Congress to act on legislation to improve U.S. energy security. We support his call to action, and believe that nuclear energy must play an integral part of our national energy strategy.

THE NEED FOR STANDARDIZATION AND LICENSING REFORM IN THE U.S.

Nuclear energy plants will be competitive in the 1990s if obstacles now preventing utilities from ordering them are removed. Some of the necessary steps are beyond the limits of what the industry can accomplish by itself. The Congress, Administration, Nuclear Regulatory Commission, and state regulators all have vital roles to play.

There is a need for legislation to remove certain obstacles to nuclear energy development. First, we believe that legislation is needed to further improve the licensing process. Second, it has become apparent that legislation is needed for DOE to characterize the Yucca Mountain site in Nevada. Finally, there is a need for legislation to clarify the role of the states in nuclear energy regulation. The Congress is grappling with this question in the context of the Clean Air Act Amendments.

Economics

Perceptions about economics are among the main obstacles to nuclear energy development. The recent history of licensing

delays, regulatory vacillations and state public utility commission disallowances leaves a record of high risk both for the operator and the investor. In actuality, the problem is that the economics of nuclear energy have proven highly unpredictable.

The greatest variables in the cost of nuclear energy plants have been changes to the plant during construction and the length of the construction period. Standardization and licensing reform will reduce construction costs by preventing unnecessary design changes during construction and requiring resolution of design and licensing issues before construction. Under the previous process, many final decisions regarding design safety, siting, and other licensing issues were only resolved after issuance of the construction permit. Delays in the resolution of issues under this process had a serious negative effect on costs.

In the 1980's, it took anywhere from six to 20 years to build and license nuclear plants in the United States. On average, construction and licensing took 14 years in this country, compared to five years in France, Japan, Taiwan, and South Korea. Since electric utilities must borrow the funds to construct nuclear plants, the cost of a plant rises dramatically as this construction period lengthens.

Given the variable length of construction periods under the previous licensing process, it should come as no surprise that there were wide ranges in the cost of nuclear plants. In the 1980's, the cost of nuclear plants varied anywhere from $1.6 billion to $6 billion, with the average being $3 billion.

Although it is difficult to quantify the cost of delays under the previous licensing process, I will cite one example. In 1984, construction of the Seabrook nuclear plant in New Hampshire was completed. However, the plant was not granted an operating license until 1990, six years later. During this period between completion of construction and granting of the operating license, plant costs rose $1.8 billion. In my view, this sum represents the cost of Seabrook licensing delays. To place this sum in perspective, the cost of licensing delays at Seabrook was greater than the average cost of plant construction in France, and more than it cost to build some plants in the U.S.

Based on industry reports, standardization and licensing reform can reduce plant construction costs by about 55 percent. First, standardization can reduce total plant costs by 10 percent through substantial savings in direct and indirect plant construction costs. Most of these savings result from reductions in design and management services by utilizing the same designs in several plants and cost sharing by multiple facilities. In addition, construction costs would be reduced through increased productivity, modularization, shared construction experience, and reductions in equipment and material costs.

Second, an improved licensing process that provides for operation within six years of the start of construction could reduce total plant costs by 45 percent. The most important step toward reducing nuclear plant construction costs in the United States is shortening the construction period. Requiring the resolution of design safety, siting, and other licensing issues before construction will dramatically reduce the length of the construction period, since the belated resolution of these issues was the root cause of licensing delays under the former process.

Safety

The safety improvements at operating nuclear plants over the past decade have been widely acknowledged, even by industry critics. There has been a continual increase in plant safety over the past decade and we expect that to continue. Standardization also can provide even greater margins of safety. The advanced reactor designs considered for design certification incorporate advanced safety systems that promise an even higher level of safety than current plants. For example, the EPRI Advanced Light Water Reactor Utility Requirements Document incorporates a safety goal of less than a one-in-one million cumulative probability of severe accident which may result in an offsite radioactive release.

We are hopeful that public awareness of safety improvements in current plants as well as improvements offered by advanced reactor designs under development by the industry will alleviate concerns about the safety of nuclear energy plants.

NUCLEAR REGULATORY COMMISSION FINAL RULE

Efforts to develop and implement standardization and licensing reform, either through rulemaking or legislation, stretch back 20 years. The NRC issued a policy statement on standardization and licensing reform in 1972, although it did not proceed with the anticipated rulemaking. Since that time, three Presidents have submitted standardization and licensing reform legislation to the Congress. Although hearings were held on these proposed bills, no legislative action was ever taken.

In April 1989, the NRC issued a sweeping final rule that fundamentally reformed the licensing process for new nuclear plants. This rule, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Reactors," establishes a licensing process that corrects many of the serious flaws in the previous regulatory process.

The final rule has three major parts: (1) Early Site Permits, (2) Advanced Reactor Design Certification, and (3) Combined Construction Permit and Operating License. One year later, the NRC rule is already being utilized by vendors submitting designs for certification and various parties that have expressed interest in the DOE Early Site Permit Program.

The final rule promises to go far toward improving the licensing process, which in turn will improve the safety, reliability, and economics of nuclear energy. Early site permits, certified designs, combined licenses -- all these are necessary steps. The most significant benefit of the final rule is that it will increase the certainty regarding nuclear plant costs and availability and thereby reduce regulatory risks posed to utilities. The rule accomplishes this by requiring resolution of key issues before construction. In this way, the final rule should prevent the most egregious failures of the previous licensing process from recurring.

At this time, I would like to briefly present the views of the industry on the rule and its implementation by the NRC:

Early Site Permits

Under the final rule, an electric utility or other company would apply for an early site permit for one or more nuclear energy plants prior to an application for a combined license. In this way, siting issues could be resolved before construction.

Importantly, public hearings must be held on applications for early site permits. This is a major improvement over the previous process, because it provides for public participation in siting issues, such as emergency planning, at an early stage.

Last January the DOE announced its Early Site Permit Demonstration Program, which is intended to demonstrate how the final rule would be utilized to obtain an early site permit.

Design Certification

Design standardization is achieved by NRC certification of an entire nuclear energy plant design which is then usable for a multiple number of nuclear units or at a multiple number of sites. Some plant designers have submitted designs for certification under 10 CFR Part 52, and others, including some foreign companies, have expressed interest in applying for design certification under the final rule.

Public hearings would be held on design certifications, although they may be informal rather than adjudicatory because design certifications will be granted through rulemaking. Members of the public may participate in a design certification rulemaking proceeding by submitting comments and by participation as parties in the hearing phase of the proceeding.

Since last year, the industry has been working with the NRC on implementation of the design certification provisions of the final rule. We have laid out our position to the Commission:

- The NRC must certify designs by the early-1990's to allow electric utilities to consider ordering nuclear plants within the next several years. We believe the evolutionary light water designs can be certified by 1991-92 and the passive light water designs by 1994-95.

- The level of detail required for design certification should be that necessary to make safety determinations. The NRC should not require a level of detail that goes beyond the level prescribed in the final rule.

- The NRC should adopt what has come to be called the "two tier approach" to certification. Tier 1 would describe the certified portions of the design and Tier 2 would identify the portions which, though not certified, were reviewed and approved in the rulemaking proceeding period. This two tier approach is the only viable approach to be developed.

It is important that there be no delays in the schedule for certification of advanced reactor designs. Utilities will not consider ordering nuclear plants under Part 52 until designs are certified. In this light, the NRC controls the schedule for the next nuclear energy plant order, since an order will not be seriously considered until completion of design certification. At the request of the NRC, the industry is preparing suggestions for improvement of the design certification review process.

Resolution by the NRC of the level of detail required to make the safety determinations necessary for certification will have an important impact on schedule. A requirement for a level of detail beyond that necessary to make safety determinations on design certification are not appropriate, will cause delays in certification, and do not further enhance public safety.

The Congress has recognized the need for timely completion of design certification by the NRC. For example, the report accompanying the Fiscal Year-1991 Energy and Water Development Appropriations Bill approved by the Senate contained the following statement:

> "The Committee is concerned about the schedule slippage for completion of design certification reviews by the Commission for evolutionary and passive reactors. The Committee believes that timely completion of design certification reviews is vital to meeting the country's baseload generation needs by the end of the decade by providing the nuclear option to electric utilities in their planning process by the mid-1990s.
>
> Electric utilities cannot apply for combined licenses under the improved nuclear licensing rule issued by the Commission in 1989 until reactor designs are certified. For that reason, each delay in design certification

causes a commensurate delay in the next commercial nuclear power plant order."

Mr. Chairman, the bottom line is that designs must be certified in the early-1990's in order for the industry to order additional nuclear plants in the mid-1990's. If designs are not certified, utilities will not consider ordering nuclear plants.

Combined Licenses

Under the previous licensing process, two licenses were needed to authorize construction and operation, respectively. The final rule fundamentally improves this process by consolidating these licenses into a combined construction permit and conditional operating license, called a combined license.

In its application for a combined license, a utility would reference a design previously certified by the NRC and may even reference an early site permit previously issued. In this way, the bulk of the design and siting issues would have been previously resolved and precluded from consideration in combined license proceedings. For all practical purposes, the only remaining issues would be site-specific considerations not covered by the design certification. As was the case with early site permits and certification, public hearings will be held on applications for combined licenses.

Once a combined license was issued, the focus of NRC activities would shift to ensuring a plant has been built in conformance with its combined license. Inspections, tests, and analyses would be administered, and results compared to acceptance criteria specified in the combined license. Such inspections, tests, analyses, and acceptance criteria would have been established in the design certification and combined license proceedings and would have been subject to public hearings. If the results meet the acceptance criteria, NRC would determine the plant was built in conformance with the combined license.

Although the NRC has maintained in its congressional testimony and public statements that the opportunity for a public hearing is limited, the industry remains very concerned about the prospect of preoperational hearings of indefinite duration. Based on past experience with preoperational hearings, we are gravely concerned that these hearings under Part 52 could be used for the purpose of delaying plant operation, similar to Seabrook, rather than assuring conformance with the combined license.

Plant construction under a combined license can and must be completed in 5 or 6 years to be economic. This is possible only if NRC properly relies on the results of inspections, tests, and analyses conducted throughout construction to determine whether the plant was built in conformance with the combined license.

CONCLUSION

There is significant concern in the industry about the degree of regulatory risk presented by the opportunity for a preoperational hearing in the final rule. Importantly, utilities have stated they will not order more nuclear plants if there is a prospect of lengthy delays in operation due to preoperational hearings. This fact is confirmed by a survey last year of 20 utilities by the Southern States Energy Board, "Analysis of Nuclear Licensing Reform Proposals from the Perspective of Utility Chief Executive Officers." In this survey, only 2 utilities declared they would consider ordering more nuclear plants if there were a chance of preoperational hearings.

This was one of the main conclusions of the survey:

> "One major licensing issue that serves as a barrier to nuclear plants is the possibility of a post-construction public hearing. Seventy percent of the respondents said they would not order a plant, or it is unlikely that a plant would be ordered, if the possibility of such a hearing exists, even if the scope of issues which could be raised was very limited."

Likewise, the NRC's final rule was met with criticism by the financial community. According to a report by Touche Ross & Co. commissioned by the Department of Energy, "Nuclear Licensing Reform and the Financial Markets," the rule will not serve as an adequate basis for investment because a rulemaking is more subject to change than legislation. These conclusions were expressly stated in the report by Touche Ross:

> "From the investment community perspective, the NRC rulemaking is not sufficient to create a climate conducive to an investment in a new nuclear power plant absent congressional endorsement of the policies it contains. The substance of the policy positions established by the NRC's actions are important and resolve the majority of the deficiencies in the licensing process. The problem is that the NRC's action is a rulemaking, not legislation. The NRC's action will not be sufficient to stimulate investor confidence sufficient to examine the financial viability of a nuclear project for two principal reasons: (1) legislation would create a stronger and more durable federal commitment than an agency rulemaking, and (2) legislation would alleviate concerns about the statutory foundation of the policy. ...Absent legislation, the possibility remains that a future Commission could also issue a rulemaking that would eviscerate the fundamental provisions and protections in the current rulemaking."

The nuclear energy industry has reacted positively to the NRC final rule. Plant designers are submitting new designs for certification, and there is interest in the DOE Early Site Permit Demonstration Program. However, the level of interest cannot be fully measured until designs are certified and utilities can seriously consider ordering new nuclear energy plants.

The industry believes the final rule is a giant step forward toward establishing a regulatory process necessary for continued nuclear energy development. However, there are significant open questions that need to be resolved regarding the rule, such as the level of design detail, the nature of preoperational hearings, and the timing of design certifications. Proper resolution of these issues is necessary for continued nuclear energy development. These questions must be resolved soon.

The industry also believes there is a need for legislation to further improve the licensing process. Legislation should address the prospect for preoperational delays as well as codify the rule. The rule is an excellent starting-point, but the time has come for the Congress to take action.

The electric utility industry is prepared to consider ordering more nuclear plants in the 1990's. To meet this goal, the industry must have certified designs and a licensing process that leads to stable and predictable plant construction.

United States Senate
Committee on Environment and Public Works
Subcommittee on Nuclear Regulation

Hearing on the Standardization of Designs and Licensing Process for Nuclear Power Plants

September 18, 1990

Testimony of
Dean R. Tousley
on behalf of the
Union of Concerned Scientists

Mr. Chairman, Members of the Subcommittee--

My name is Dean Tousley; I am an attorney with the firm Harmon, Curran & Tousley, counsel to the Union of Concerned Scientists. On behalf of UCS, I thank you for this opportunity to address the Subcommittee on the important issues of nuclear power plant standardization and the licensing process.

Standardization in General

UCS supports the principle that standardization has the potential to enhance overall nuclear power plant safety. However, we disagree with the NRC, DOE, and nuclear utilities as to what constitutes standardization and how to achieve it. A fundamental question that is not being asked in the consideration of standardization is what we are trying to accomplish by it. Before it considers certifying any designs, the Commission should first decide that enhanced safety is the primary objective of standardization. Then, it should establish significantly enhanced safety goals for any standardized plants. There should be no thought of standardization based solely on standards now applicable to existing plants.

Standardization will be frustrated if too many designs are certified. NRC is considering designs from any domestic vendors who proffer them--and might open the process up to foreign vendors, as well. Nobody is asking what the implications of various design types might be for such issues as spent fuel reprocessing, nuclear proliferation, etc. For example, if we are not going to have fuel reprocessing in this country, there is no reason to consider designs based on liquid metal reactors, which are essentially breeder reactors whose long-term operation and economics are based on reprocessing.

Perhaps the Commission should have a design competition and choose one or two or at most three designs that best achieve the enhanced safety goals for certifica-

tion. This is more or less how the much safer Naval reactor program has been run. There is no reason we need to certify designs from every vendor that comes up with one.

Standardization also will not be achieved if certification is not based on essentially complete designs. The utilities and DOE are unwilling to commit to a specific and detailed design to be standardized. They seek a regulatory regime that would allow the NRC to approve designs so minimal in detail that they have been described by some as "wishful thinking" and "cartoons." NRC Chairman Carr and to a lesser extent Commissioner Curtiss are reported to want standardization based on essentially complete designs. UCS agrees with Chairman Carr on this issue.

In a tremendous irony, utilities and DOE now want to have designs approved in a two-step process. After succesfully convincing the Commission that they could no longer tolerate the two-step licensing process, they now want to return to the two-step design approval process that characterized the old construction permit/operating license system, but without hearings in the second step, of course. This is the antithesis of standardization. There will be so many variations and modifications on the "certified" designs that there will be virtually no more standardization than there is now.

The Commission's Standardization Rule

Under the banner of standardization and one-step licensing, the Commission has promulgated a rule that oversteps the bounds both of good policy and of the law. In the name of early resolution of issues, the rule has provisions that make it impossible to ever meaningfully consider some important safety issues. They also run afoul of the Atomic Energy Act requirement for post-construction findings of compliance prior to issuance of an operating license. In the name of standardization, the Commission has promulgated provisions that unreasonably lock out safety improvements for decades.

The new rule provides for Commission issuance of a "combined license," which is comprised of a construction permit and "operating license with conditions." The rule calls for inclusion in the combined license of all tests, inspections, and acceptance criteria necessary for the Commission to find, at the end of construction, that the facility meets all requirements. It further limits any post-construction hearings to whether those tests, inspections, and acceptance criteria have been met. The types of procedures that would be employed would be at the Commission's unfettered discretion. Post-construction challenges to the terms of the combined license itself, including the acceptance criteria, would have to be brought under the Commission's very high threshold "show cause" provision for seeking to modify, suspend or revoke a license, 10 CFR Section 2.206.[1]

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[1] Section 2.206 of the Commission's regulations provides that any person may request the Commission to institute a proceeding under section 2.202 to modify, suspend, or revoke a license by serving on a licensee an order to "show cause." The request is referred to the appropriate NRC office, the director of which may either institute the requested proceeding or deny the request. The director's decision may not be appealed to the Commission, and according to the position of the Commission, may not be appealed in any court. In practice, this provision has proven to be an empty promise at

This provision is unacceptable both as a matter of policy and as a matter of law. Section 185 of the Atomic Energy Act requires the Commission to find, before issuing an operating license, that a facility has been constructed and will operate in conformity with the AEA and the Commission's regulations. The apparent objective of the Commission's rule is to embody the full substance of the section 185 findings in acceptance criteria that would be made part of the combined license. The Commission would then supposedly be able to fully satisfy its section 185 obligations by simply finding, at the end of construction, that those acceptance criteria were satisfied.

However, it is unrealistic to expect to devise in advance of construction a set of acceptance criteria that can comprehend all of the considerations that must implicitly go into the Commission's section 185 findings. Some issues are simply not amenable to determination by pre-arranged tests. For example, possible events during construction such as quality assurance failures or the use of counterfeit equipment cannot be comprehensively foreseen or detected by tests, inspections and acceptance criteria. Inspections can address some of these issues, but certainly not exhaustively. All components cannot be independently inspected--only spot testing is feasible. If the prescribed spot inspections are passed, but a plant or contractor employee comes up with credible claims of QA problems not covered by the prescribed inspections, the Commission's rule would prevent litigation of those issues in any pre-operation hearing. The only way such issues could be adjudicated is through a section 2.206 show-cause petition challenging the acceptance criteria, i.e., seeking to amend the license. The public should not be required to meet so difficult a threshold standard in order to get Commission consideration of such obviously relevant safety issues in the licensing proceeding.

Other issues cannot be covered by pre-defined tests, inspections and acceptance criteria simply because they are not known about. New, unforeseen safety issues crop up continuously with respect to nuclear plants as a result of operational experience, safety research, and advances in technology. Such a new issue might become apparent five years into construction of a plant. Under the Commission's rule, that new issue could not be considered in the post-construction proceeding if it was not covered by the pre-defined acceptance criteria. The possibility that acceptance criteria will be sufficient to encompass all of the Commission's required pre-operation safety findings is made even more remote by the fact that those criteria will be suggested in the first instance by the vendors of the designs, who hardly have an incentive to put forward rigorous criteria.

The Commission **should** require submission of a complete nuclear plant design prior to construction, as the language of the new 10 CFR Part 52 suggests. It is correct to litigate design and siting issues as much as possible prior to construction--

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(continued)

best, as the Commission in recent years virtually *always* denies 2.206 petitions.

either in the combined license proceeding, or in earlier proceedings on Early Site Permits and standard design certifications. However, where there is significant new information or substantially changed circumstances, it must be possible for siting and design issues to be considered again prior to operation.

The Commission errs in thinking that it can resolve all construction-related issues prior to construction, and deny a hearing on those issues at the end of construction. As a matter of law, the Commission may not issue an operating license until after making the section 185 post-construction findings of compliance. Any safety-related issues that have not been resolved prior to construction or dealt with comprehensively by tests, inspections, and acceptance criteria, such as quality assurance or new information, must be open to potential litigation in a post-construction hearing.

Section 185 of the Atomic Energy Act does not permit the Commission to issue any kind of operating license--even a conditional one--until after construction is completed and it has found that the facility *has been constructed* and *can be operated* in conformity with the requirements of the Atomic Energy Act and the Commission's regulations.

The Commission purports to maintain consistency with section 185 by claiming that the operating license component of the combined license under its rule would be conditional--i.e., not be *operative*--until after it has made the requisite section 185 findings. However, this does not satisfy section 185 or make the distinction between "operation" and "issuance of a license" merely semantic. To the contrary, the distinction has profound consequences both for the scope of the pre-operation hearing and for the participation rights of the public in that hearing. The net effect of the provision is to deny to the public its Atomic Energy Act section 189(a) right to a hearing on issues relevant to an operating license.

Contrary to NRC's mis-characterization of our position in the introduction to its rule, UCS does *not* maintain that all construction permit issues should be available for re-litigation prior to operation. We thoroughly endorse the principle that the majority of issues should be resolved prior to construction, and that, if there is no significant new information or substantially changed circumstances, those resolved issues should not be revisited at the end of construction.

The Commission has gone too far, however. By considering that the operating license has already been issued, the Commission would require that any post-construction challenges to its terms--including the acceptance criteria--must be brought as section 2.206 show cause petitions seeking amendments to the license. The threshold standards for even granting hearings on such petitions are extremely high--indeed, they have virtually never been granted in recent years. The only example of granting a 2.206 petition the Commission came up with in current litigation on this issue was a petition UCS filed in 1980. According to the current legal position of the Commission, its denials of show cause petitions are not even reviewable in court, and several federal courts of appeals have agreed with that legal position.

Standardization

The concept of standardization of nuclear plant designs is one which UCS has long supported. There is no question that some of the problems of the present generation of reactors can be traced to the fact that virtually each one is a custom job. By standardizing on a few designs, both the industry and the Commission should be able to benefit a great deal more from experience at other plants. Unfortunately, some provisions in the rule work to significantly reduce the safety enhancement which standardization might be able to achieve.

Existing Designs

Among its most regrettable mistakes is the fact that the Commission has failed to require satisfaction of enhanced safety goals in order for designs to qualify for certification as standard designs, thus permitting standardization based on current designs as well as potentially safer ones. Thus, the Commission shows an imprudent willingness to certify designs that, according to its own estimates, present a 45% risk of a severe core melt accident in the next 20 years. The Commission's rule should specify that design certification will be forthcoming *only* for designs that can satisfy new, enhanced safety criteria. Such a requirement would provide strong stimulus for the development of safer designs, as well as contribute substantially to creation of better public confidence and trust.

Ironically, the Commission's rule may actually act as a disincentive to the development of safer plants. The rule permits standardization based on existing designs, but properly requires prototype testing as a prerequisite for certification of most advanced designs. Thus, the rule presents a powerful economic disincentive to the safer plants, since it will be much costlier to obtain their certification. The prototype testing requirement for advanced designs is entirely appropriate, but consideration of certifying current or "evolutionary" designs is not.

Public acceptance also requires that standardized designs be limited to safer plants. Recent public opinion polls show that the majority of the American public has a low opinion of this industry, and does not favor construction of more nuclear plants. The public clearly will not support a resurgence of nuclear power in this country based on plants that are only comparable in safety to Three Mile Island.

Extreme Backfit Rule Implementation

In the name of standardization and stability, the Commission has implemented an unjustifiably extreme form of backfit[2] limitation in each aspect of this rule. Early

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[2] The Commission's backfit rule provides that the Commission may require the modification of a facility only if "there is a substantial increase in the overall protection of the public health and safety or the common defense and security to be derived from the backfit and ... the direct and indirect costs of implementation for that facility are justified in view of this increased protection," or if the backfit is necessary to bring a facility into compliance with regulatory requirements or to assure adequate protection of the public health and safety. 10 CFR section 50.109(a)(3) and (4).

site permits have a duration of 20 years, and may be renewed based on the standards in effect at the time of initial issuance, rather than the standards in effect at the time of renewal. Similarly, standard design certifications are good for 15 years, and may be renewed based on the standards in effect at the time of initial issuance, rather than the standards in effect at the time of renewal.

It is the antithesis of the Commission's responsibility to ensure adequate protection of the public health and safety for it to lock out possible safety improvements for such long periods of time. It is especially absurd to do so when the entities being "protected" against new requirements are not physical facilities, but merely unrealized permits. It is quite reasonable and hardly burdensome to require the holder of a standard design certification that is issued in 1990 to meet the standards in effect in 2005 when he wishes to renew the certification in that year. It would require at most redesign work, not costly retrofitting of an existing physical facility.

Similarly, it is reasonable to require the holder of an early site permit that is issued in 1990 to meet the emergency planning and other environmental standards in effect in 2010 when a renewal is sought. If the new requirements would prohibit use of the site for a nuclear plant, it would be unconscionable for the Commission to grandfather the site when there is as yet no plant there.

Under the Commission's rule, it could issue a combined license to a utility in the year 2020 using a site and a design that only meet the standards of 1990. This carries the concept of standardization and stability to absurd extremes. The rule also makes it very doubtful that the Commission could make its requisite section 185 findings that the facility has been built and can be operated in conformity with the Atomic Energy Act and Commission rules, since the requirements the facility meets may be decades old and utterly obsolete.

The Subcommittee's Questions

The Subcommittee posed several questions in its invitation to testify at this hearing. The responses to those questions follow.

Standardization

1. To what extent, if any would standardization of nuclear power plant designs improve the safety, reliability, and economy of nuclear energy?

Standardization--properly implemented--would seem to have the potential to enhance both the overall safety and the economics of nuclear power, but we are not able to predict the extent of any improvement.

2. What are your views on the policies and procedures that the Nuclear Regulatory Commission and the Department of Energy have established to encourage the standardization of designs?

As discussed extensively above, the potential safety benefit of design standardization is seriously marred in the NRC's rule by provisions which permit the approval of designs by rulemaking rather than by adjudication, and which permit standardization based on current designs rather than insisting on safer ones. Before certifying any designs, the Commission should first promulgate enhanced safety standards for any such designs. In addition, the concept of stability of permits has been carried to unjustified extremes in the Commission's rule, such that standardization will in practice become the equivalent of ossification, with desirable safety improvements locked out for 30 to 40 years or longer.

The objective of early resolution of issues has likewise been carried to extremes in the Commission's rule. The Commission has gone too far in attempting to decide all issues prior to construction. Some safety issues relating to the construction of the plant, as well as new developments during construction, cannot be resolved in a pre-construction hearing, nor can they be meaningfully incorporated in tests, inspections, and acceptance criteria. By making it impossible to consider such issues in a post-construction hearing except under 10 CFR section 2.206, the Commission has greatly increased the likelihood that vital safety issues may never be meaningfully considered at all.

3. What is your opinion of the industry's and DOE's efforts to develop and NRC's efforts to certify evolutionary, advanced, or other standardized designs?

As discussed above, UCS does not believe that the NRC should entertain standardization based on current or "evolutionary" designs at all. The Commission should first declare that the primary purpose of standardization is to significantly enhance safety, issue enhanced safety standards that any standardized designs will be required to meet, and then select two or three advanced designs that best meet those standards. The advanced designs should be virtually complete in their level of design detail and should be required to undergo prototype testing prior to their certification.

4. Do you recommend any legislation to improve the process for standardization?

Yes. We would recommend legislation that requires that standard design certification be available only to designs that can meet enhanced safety standards. In addition, certification should be accomplished by means of adjudication rather than rulemaking. We believe the law already requires meaningful opportunity for a hearing at the conclusion of construction and prior to operation on any issue relevant to whether the plant has been built and will operate safely.

The Licensing Process

1. To what extent, if any, was the two-step licensing process that was used prior to the recent revision of those procedures responsible for cost overruns and delays in the licensing of nuclear power plants in the 1970's and 1980's?

The cost overruns and delays that characterized licensing of certain plants in the 70's and 80's resulted not from the licensing process itself, but rather from serious substantive problems at those plants, as well as accelerating interest rates, poor design, quality control and construction, excess generating capacity, and increased prudency reviews by public utility commissions.

The most notorious examples of "licensing delay" are Shoreham and Seabrook. The problems these plants had getting their operating licenses were in large part a result of the Commission's refusal to consider emergency planning issues raised by intervenors in the first, or construction permit, step of the two-step process when it made sense to do so. By refusing to consider the severe emergency planning problems at those plants until the operating license proceedings, when billions of dollars had already been spent, the Commission guaranteed than when those problems turned out to be very serious and adverse to the plants' operation, there would naturally be substantial problems with licensing. Ultimately, rather than face up to the fact that those plants should never have received construction permits, the Commission resorted to gutting its own emergency planning requirements in order to license those facilities.

On the other side of the coin, the Zimmer plants in Ohio are a good example of the value of the hearing process. Those two plants were cancelled by their owners when they were 95 percent complete because the operating license hearings revealed that they suffered from complete breakdowns in quality assurance.

Nothing inherent in a two-step licensing process causes inordinate delays or cost overruns. If the Commission had permitted consideration of all the relevant siting issues, including emergency planning, in the construction permit proceeding, both Seabrook and Shoreham would probably have been cancelled before they were built. If there had not been meaningful pre-operation hearings, the Zimmer plants might have gone into operation with their host of serious safety problems. In general, we are confident in concluding that hearings never caused much delay unless there were serious, substantive problems with the plants involved. In other words, hearings have resulted in delays precisely in situations where they should.

2. Please describe your views on the NRC's new licensing procedures.

NRC's new licensing procedures are illegal as well as bad policy. Indeed, together with the Nuclear Information and Resource Service and Public Citizen, we are challenging the rule on standard design certification, early site permits, and combined licenses, which is the primary subject of this testimony. That lawsuit charges that the Commission's attempt to grant a combined license including an operating license prior to plant construction and to unjustifiably constrain the litigation of issues after construction but prior to operation violates sections 185 and 189(a) of the Atomic Energy Act, as discussed above.

UCS is also currently involved in litigation challenging the Commission's recent revisions to its procedural rules for nuclear plant licensing, 10 CFR Part 2. In that rule, the Commission significantly raises the standard that intervenors must meet in getting contentions admitted, without providing access to the key staff documents on which the licensing proposal is based. In addition, it codifies a requirement that intervenors must meet a much higher threshold for late-filed contentions, even when those contentions could not have been filed earlier due to the unavailability of these NRC Staff evaluative documents.

These rules, taken together, will make the already difficult process of intervening in NRC licensing proceedings virtually impossible to sustain. The one-step licensing rule, by virtue of its timing considerations as well as the constraints on participation already discussed, will effectively prevent most interventions. The rule can only have a profoundly negative effect on public perceptions of the nuclear industry and its regulation.

When a notice of application for a combined license is published, citizens will inevitably wish to challenge the site and the design. They will be told, "We approved this site 30 years ago. Where were you then? The site still meets the requirements from 30 years ago, so you may not challenge it now." They will also be told, "We approved this design by rule 25 years ago. Why did you not submit comments then? Even though the design does not meet all of today's requirements, it still meets the requirements from 25 years ago, so you may not challenge it now." You can well imagine the impact this "Catch-22" will have on public confidence in nuclear technology.

After the plant is constructed, the citizens will not have an opportunity for a hearing on the adequacy of the facility as built. Instead, the citizens will merely have an opportunity to allege that the facility does not satisfy its own acceptance criteria, many of which were devised in the design rulemaking 25 years before the combined license was issued. The procedures to be used in considering any such issues will be at the Commission's sole discretion. If new information has arisen bearing on the adequacy of the plant as built, the citizens must use 10 CFR section 2.206 in order to get Commission consideration of the issues. The Commission's denies virtually all of 2.206 petitions it receives, and according to the Commission, those denials are unreviewable in court.

3. In your opinion, will these procedures improve the licensing process for nuclear power plants?

No, but they will do extensive additional damage to the public's already low perception of this industry and its regulators. It is inescapable that the public, when it becomes aware of these rules, will perceive them as attempts to curtail public participation, and as attempts to protect the Commission's licensees and applicants from new safety requirements for decades at a time. The message which the public will receive is that the Commission is abetting the nuclear industry in avoiding meaningful

public scrutiny. Its already low perception of the safety of the industry will not be improved. If the nuclear industry can really come up with safe and competitive designs, then they should be willing to display and defend their wares in public hearings. That is the only way they can succeed in building public trust.

4. and 5. Are there any further changes that would improve the licensing process? Do you recommend any legislation to improve the licensing process?

As conveyed above, UCS does not equate improving the licensing process with curtailing public participation in the licensing process. Thus, we would certainly not advocate "further" changes along the lines of those promulgated thus far. The NRC should abandon as its primary working principle the notion that hobbling meaningful participation by the public will somehow rejuvenate the nuclear option. If anything, the opposite is true, for without public acceptance, there will certainly be no resurgence of nuclear power development in this country. These efforts are extremely damaging to the prospects for public acceptance.

UCS would welcome legislative changes that reaffirm the public's hearing rights under section 189(a) of the Atomic Energy Act and clarify to the Commission that its attempts to constrain those rights into uselessness are inconsistent with that section and with Congressional intent. We would also welcome legislation that re-establishes the right to judicial review of the Commission's denials of show cause petitions. If the Commission is going to shift a large portion of the public's participation rights from licensing hearings to show cause proceedings, it should at least know that its nearly automatic denials of those petitions will continue to be subject to judicial scrutiny.

September 13, 1990

Presentation by Mr. Remy Carle

on standardization

September 18, 1990

Faced with the effects of two consecutive oil crises and the serious danger they posed to France's independence in energy terms, we have been pursuing an ambitious nuclear energy program since 1973. 75% of France's electric power is now generated from uranium resources.
Proud of our own successful program for nuclear energy, we are paying particularly close attention to the problems experienced by other industrialized countries when implementing similar programs. We are living in a period of increased international exchanges and cross-border flows of information, so it is important to gain a clear vision of why some experience problems where others succeed. This paper sets out to demonstrate the decisive role that the standardization policy, which we adopted right from the outset, has played in ensuring the success of the French nuclear power program.

1. The French nuclear energy program

As of December 31, 1989, the quantity of nuclear power installed on French territory totalled 52,600 MW. This figure includes the 52 nuclear power plants operated by EDF:

- 4 UNGG-type reactors (natural uranium reactors with carbon dioxide cooling and graphite moderation);
- 48 PWR reactors of two different sizes: 900 MW (3 loops) and 1300 MW (4 loops).

EDF also participates in other power plants on French territory:

- Chooz A light water reactor;
- the Phenix and Superphenix prototype fast breeder reactors.

In the course of 1990:

- two of the UNGG reactors were shut down, and the remaining two are due for closure in the coming years;
- three more 1300 MW PWRs were hooked up to the grid.

Nuclear power output reached record levels in 1989 : 285 TWh for EDF, which represents a 10.8% increase over 1988, 289 TWh at the national level, respectively 79.7% of total EDF output, and 74.6% of total national output. Depending on the method of calculation adopted, the percentage is therefore either 80% or 75%.

In view of its size and high performance, the nuclear system does not operate on base load alone, but now makes a significant contribution to load following and frequence regulation.

These figures clearly show how important the nuclear system is to EDF. Nuclear power is one of the key factors behind EDF's commitment, under the national contract with the French Government, to reduce the price of electric power in the medium term.

With the sole exception of the Scandinavian countries, our electric power is now the cheapest in Europe, a fact that has two obvious consequences: foreign industrial companies, in fields which we thought they would never return to France, are investing again ; exported kWh now represent more than 10% of output, and could even reach 20% by the beginning of the next century.

It is also important to note that the competitiveness of electric power in relation to other energy forms has increased electricity's share of total French power consumption (38% of total energy consumption in France in 1989, and 52% of power consumed by industry) and substantially improved the nation's self-sufficiency from 23% in 1973 to 48% in 1989.

Despite the implications of certain critics, the French nuclear program has not been halted and is not yet finished. 5 reactors are currently under construction: 3 1300 MW units will enter service in 1993, and 2 1400 MW N4 series units are due to come on stream in 1992 or 1993. EDF recently received authorization from the Ministry of Industry to begin work in 1991 on a further N4 series unit, Civaux 1.

The process to replace oil with nuclear power is complete. Now we are looking at changes in domestic demand in France and export markets, which imply only moderate new commitments to nuclear power in the coming years.

We are currently following two parallel courses of action: one to improve the performance and reliability of the units in service, and the other to prepare the nuclear programs of the future.

The most significant developments in the nuclear system currently in service concern core management, i.e. better use of uranium resources. We are gradually increasing the combustion rate (burnup) of the fuel and are introducing MOX fuels that allow for the recycling of the plutonium generated by the reprocessing of irradiated fuels.

Looking at the future, our main objective is to replace the current generation of nuclear power plants by 2010-2030, when a daunting construction rhythm of some 3000 MW per year will be required. We are preparing for the future with great care within the framework of our REP 2000 study program.

As of today, this program is still very open, since it includes all the feedback from our own PWRs, and a close analysis of all new developments in the nuclear power plant technology throughout the world. Clear objectives will emerge during the 1990s and an R&D program will be formulated to form the basis of future series.

The REP 2000 program already has an international dimension, following the signing of cooperation agreements with different European electric power utilities.

This brief overview of the French nuclear power program would not be complete without mentioning the extensive range of resources and facilities that are an integral part of the nuclear power industry. Assets range from uranium mines to disposal facilities for low-activity waste, and include the crucially important uranium enrichment and irradiated fuel reprocessing stages. All that is missing is a disposal facility for high-activity waste. Vitrification technology, which was developed in France, provides the solution to this problem. However, no high-activity disposal has yet been opened, mainly due to local public opposition.

By way of conclusion, it is worth noting that the French nuclear power plants represent about one-half of the current system in the United States.

2. Background to standardization policy

EDF has followed standardization policy since it began building its fossil fuel-based generation system in the 1960s. The utility developed the 125 MW, 250 MW, 600 MW, and 700 MW series, but the standardization policy cannot be qualified as a total success.

Following the attempt to develop a French technology - the UNGG - the decision was taken in 1970 to import a technology from abroad; the technology in question being the PWR developed by Westinghouse, which was making inroads the world over at the time. The first unit - Fessenheim 1 - was ordered in 1970 and came into industrial service in 1977. From 1973 onwards, the rhythm accelerated significantly. The complete 900 MW series, totalling 34 reactors, was launched over a ten-year period, and work was started on the first 1300 MW reactors as early as 1977. It soon became clear to the French authorities that, in view of the limited resources available, a decision should be taken to concentrate

on a small number of precise objectives. This was the dawn of the standardization policy. The decision taken in 1975 to abandon the boiling water type reactor was an admission that we were unable to research, develop, analyze, and manufacture two different types of power plant.

The 56 PWR nuclear power plants in service today all clearly derive from the same technology. The original Westinghouse version was gradually "gallicized" and through our industrial partner - Framatome - the licensing agreements were transformed in 1981 into a cooperation agreement. The French solution is now a serious option on world markets.

But this does not mean that the 56 reactors in question are identical. We have already mentioned how they are divided into different size categories: 900, 1300, and 1400 MW. Further, a number of differences emerged with the passing of time. The 900 MW series is divided up into a first pre-series, including the 6 units at Fessenheim and Dugey, and two sub-series CP1 and CP2, which account for 18 and 10 units respectively. The main differences between the two sub-series concern the technology of the turbine AC generator and the conventional island, where the machine hall is arranged differently with regard to the nuclear island.

The 1300 MW series will total 20 units, which can be divided up into two sub-series, P4 and P'4, differing mainly in the machine hall technology, and a number of the configurations on the nuclear island.

Over and beyond the increase in power, changes in the switch from the 900 MW series to the 1300 MW series also affected the type of containment around the reactor (double concrete containment instead of single containment with steel liner), and the control system (change from electromechanical relay system to logic programmable controllers).

The latest series is the N4. Work on the first unit in this series was started at Chooz in 1984. This 1400 MW series features substantial changes to the AC generator technology, and the control system. Discussions of the man-machine interface dating back to the very beginnings of the nuclear era, and the Three Mile Island incident in

particular, have helped us to clearly identify the role and the needs of personnel operating this type of installation. We have developed a new control room for the N4 series.

The 56 reactors mentioned are, finally, spread over 6 different series. But I must emphasize that these 6 series are all interconnected by a degree of technical continuity. This is particularly true of the nuclear installations.

3. Putting standardization into practice

a/ Standardization first becomes apparent in the layout diagrams and the technical specifications.

All functions are covered by specifications affecting the design, supply, manufacture, and workings of equipment. The series plans define the geographical location of the different items of equipment.

A number of functions can be designed for all the sites of a given series. For example this applies to the ventilation of the nuclear island, which takes account of the meteorological extremes experienced by the series. But, as we will see later on, site-specific installations must be chosen for other functions.

The series model includes the nuclear island, the machine hall, and certain auxiliary buildings, such as the effluent treatment facility, or the control building.

b/ The second level of standardization applies to the actual contents of the specifications, which refer to design and building codes jointly drawn up by EDF and French industrial companies.

In the absence of these codes, either the specifications had to be very detailed or reference was made to foreign codes (E.g., ASME).

The first editions of these RCC codes (Design and Construction Rules) date back to 1979, with the RCC P for processes, which defined the design,

installation, and test rules applying to power plant safety systems. 1980 saw the appearance of the RCC M codes defining the design and construction rules for mechanical equipment on nuclear islands.

These codes, which now cover the entire system, have been contractual documents since the 1300 MW P'4 series, and are gradually being applied to all series, particularly on the occasion of modifications.

The codes are used to introduce standards that meet the requirements of the nuclear power industry and provide the means of clearly exposing the industry's technical requirements.

c/ The third level of standardization applies to industrial policy. Once the technical standards have been laid down, it should be possible to call on different suppliers for construction services, and even to put out calls for tender in order to benefit from a competitive market.

EDF's industrial policy was to engage, in a number of specific cases, a close technical dialog with industrial companies of its choice, and to conclude contracts covering several units from the same series. Group contracts were signed with Framatome and Alsthom for the supply of the nuclear steam supply systems and the AC generator set respectively for installation in several units belonging to the same series.

This approach has been widely adopted and has enabled EDF to use the same components on all the reactors in a given series.

These batch contracts have enabled the manufacturers to make the investments needed to guarantee quality nuclear power. They are afforded the opportunity to conduct the R&D, laboratory tests, verifications, and prototype tests that are so important in achieving satisfactory reliability levels. The contracts also enable the contracting authority to benefit from the series effect and purchase at lower prices.

4. The consequences of standardization

The multitude of consequences can be classified in different categories.

a/ The first effect is on control over costs, deadlines, and industrial investments.

Building identical units means that the costs of R&D and the so-called "series tests" can be better distributed, supplies can be grouped together, and the series effect comes into play. By repeating identical production sequences, knowhow is strengthened and scheduling can be optimized. More than ample proof is provided by the progress made in the construction schedules of 900 MW units. The initial lead time for the first unit at Fessenheim 1 was 7 years, whereas the later units in this series were virtually guaranteed operational within 60 months. Similarly, costs have been stabilized over the last few years at approximately FFr 8000 per KW (interests included)..

b/ Standardization is also important in operational terms. It is important for power plant operators to benefit from the inclusion of similar components, the same type of physical phenomena, and the same control systems in the different units. Standardization also enables us to draw up a single body of literature for a complete series. To ensure that the personnel in each unit is capable of assimilating the corresponding control and operating modes, we are in a position to formulate identical procedures.

c/ Standardization also improves maintenance operations and spares management. We have concentrated on the problems of interchangeability of equipment. However, our current standardization policy has enabled us to consider possible technological developments of our equipment.

If a pump supplier changes his production process, or if we have to call on a new supplier, it is of the utmost importance that both models remain functionally equivalent throughout the series. Otherwise, we would have

to consider the change of pump model as a functional modification that applies to the whole series, or we would have to reject the new model.

d/ Standardization also improves training of staff performing both operations and maintenance tasks. A single body of literature exists for the complete series that can be stored in the training centers, which are grouped together so that we do not need one simulator per power plant. There are seven integrated simulators for the French generation system with full-scale control rooms that reproduce conditions encountered in every type of power plant. The 7 simulators are located in three training centers at Paluel, Bugey, and Caen.

e/ Standardization is also a means of generalizing the feedback process.

First, the quantity of data acquired during the operation of an entire series can be used to identify quickly any signs that are precursors of problems affecting a given unit, for particular cases, or the entire series, for generalized problems. The course of action required in given situations, where the need to interpret symptoms rules out immediate measures, can thus be quickly anticipated.

Last year, we experienced some problems with our steam generators in the 1300 MW series that were due to a lack of cleanliness during initial assembly. Rapid verification and cleaning allowed us to quickly solve the problem throughout the series.

Series-wide quality control procedures, which are applied to all units, afford us the means of tracing back problems encountered on a given unit to the manufacturing stage or even the series design phase.

Analysis of this feedback sometimes prompts us to implement modifications.

Steps were taken on reactors already in active service to ensure that all units in a given series remain identical. Modifications are grouped

together and carried out batchwise when reactors are shut down for lengthy periods.

Fessenheim 1 was upgraded in 1989 during its ten-year shutdown. The same upgrade will be applied this year to Bugey 2, Fessenheim 2, and Dampierre 1, during their ten-year shutdowns.

The decision may be taken not to integrate some of the possible modifications in reactors already in service. The scope of works necessary may outweigh the expected benefits. However, these modifications are taken into account for series still in the design phase.

By way of example, a simple problem of access to a shut-off valve, which may only become apparent when the unit is stopped for the first time, can seriously delay operations and affect the allocation of personnel to different tasks. Modifications will then be made on the entire series that are compatible with the operating conditions (E.g., installation of gangways to improve access). The modification can then be applied to the next series in a more effective manner by completely redesigning access to the loop in question.

This example illustrates how important it is to integrate as much information as possible into the standards with regard to the location of different items of equipment.

f/ In view of the various points I have raised, it is easy to appreciate how our dialogue with the safety authorities has been greatly improved by standardization.

There are three main points of dialogue:

- formulation and application of technical regulations;
- an authorization system for each installation based on an in-depth technical evaluation of safety measures;
- surveillance.

The operator, EDF, is responsible for the safety of its installations and deals directly with the safety authorities.

French law requires a series of mandatory results and the installation of whatever means are required to achieve these results. The operator, EDF, is required to define the ways and means of achieving these results.

I am going to look at each of the three areas one by one: regulations, authorizations, and surveillance.

The French regulations define the technical objectives. Apart from the official texts, which are approved by state decree, the RCC codes play an essential role. We saw earlier how work between EDF and industrial companies has already borne fruit. The French safety authorities analyze and approve the codes, which then come into force as official regulations.

As regards the second point, every stage of the design process, construction, commissioning, operations, and shutdown is subject to official authorization delivered by the safety authorities. In the nuclear power industry, the process is started by the Request for Authorization of Creation (Demande d'Autorisation de Création). The so-called Safety Report (Rapport de Sûreté) acts as a support for all dealings between the operator, EDF, and the safety authorities. The Safety Report is used to follow up the construction and commissioning of the reactor. The document is divided into two sections: a standard section, covering the series, and a section that is specific to each individual site. The latter covers points such as environmental factors and the results of commissioning tests. The first reactor in each series, such as Paluel in the 1300 MW series, undergoes a more thorough process that includes approval of the standard section of the Safety Report. On the other hand, the authorization procedures for other reactors in the same series are slightly less thorough.

With regard to the third point, French regulations entitle some official organizations to carry out on-going surveillance during the different stages of construction, commissioning, and operation of nuclear power plants - a task that is definitely made easier by standardization.

Standardization enables the inspection authorities to cross-check extensively and the safety authorities can accurately verify that overall technical regulations and the technical instructions included in the different authorizations have been applied.

In conclusion, it is clear that in France there is no authorization specific to a complete series that can be applied to several sites. Each unit is authorized individually, but there is no doubt that a number of phases have been simplified to a great extent by our series-based policy.

g/ The final advantage of standardization that I would like to mention is commercial in nature. We are in a position to export standards representing a tried and tested model, with the possibility to relocate manufacture of certain components, thereby enhancing the technology transfer process. We can also offer a complete range of operating services.

One example is Daya Bay, where we are building two reactors identical to the Gravelines unit, with a number of operating aids based on our model.

5. The drawbacks and limits of standardization

a/ Standardization cannot be universally applied. Standardization is sometimes unprofitable and can be very difficult to formulate.

The seismic characteristics of the Cruas site prompted us to add neoprene shafts in the foundations of the nuclear island that would have served no purpose on other sites belonging to the same series. Application of standardization would not have made economic sense.

Some sites feature cooling towers, while other use direct cooling. Water inlet and discharge facilities also depend on local current patterns.

Further, the installations used to dispatch electric power depend on network configuration and are highly specific to each site.

b/ The risk of a generalized incident is inherent in standardization, but, as I have already mentioned, standardization offers improved vision of the precursory signs of incipient problems. In more general terms, remember that standardization offers the means of harnessing the R&D, experimental, and preliminary acceptance resources that offer maximum technical guarantees. A policy of total technical quality is the indispensable corollary of standardization.

The worldwide existence of older power plants using the same technology is another advantage that helps us to minimize the risk of general incidents throughout a standardized power generation system.

Nevertheless, the danger of generalized incidents that is inherent in standardization cannot be denied and is the consequence of the above-mentioned advantages. In France, we have experienced a number of generalized problems, none of which had a serious effect on the availability of our generation system. A program for the systematic investigation of ageing phenomena has been launched to anticipate any problems that may emerge during the power plants' life time.

c/ The almost exclusive status of certain suppliers, which is the result of our combined industrial and standardization policies, occasionally requires a number additional contractual conditions. The expected series effect must not be cancelled out by a monopoly on the financial benefits of this effect.

It is important that contracting authorities be in a position to conduct effective cost accounting and analyze the costs of operations carried out by subcontractors.

These points of industrial policy should be included in contractual negotiations.

6. The French context

The application of a standardization policy, which has not been without its problems, to the French nuclear power system has succeeded thanks to a number of features that are specific to the French context. The main point is the small number of players involved, EDF being one of them. EDF is the owner of the power plants, and in its capacity of nuclear operator, is answerable to the safety authorities. EDF has therefore assumed the position of engineering authority and industrial architect, since the company is in a position to benefit from operational feedback, which is crucially important when dealing with standardized systems.

Because the operator exercises control of the design of his project (i.e., formulation of standards) and technical and financial aspects, he is able to argue the validity of the said project before the safety authorities. This is one of the keys to the durability of our standardization policy and, therefore, the success of our nuclear power project.

The other players are the Commissariat for Atomic Energy, which is in charge of product development, and leading industrial suppliers: Framatome, which supplies the nuclear steam supply system, and Alsthom, manufacturer of the generator group and the main machine hall components. The safety authorities are also clearly involved.

With such a limited number of players, it is relatively simple to develop a standard product corresponding to the technical state of the art at any given time, and to develop the product as new technical breakthroughs are made. This has been the procedure in France since 1970. In addition to a clear definition of the duties and responsibilities of all the players involved, a sustained R&D potential and outstanding industrial skills and knowhow have also buttressed the durability of this successful cooperation.

It is up to the safety authorities to decide whether to accept the proposed plan of action. The plan should ensure the durability of the standard for a given number of years and allow for subsequent step-by-step

development. One notable exception to this approach would be the sudden emergence of safety imperatives requiring innovations in the design, manufacture, and operation of the power plants.

The players involved in the French nuclear power program were prompted to take a number of steps following the Three Mile Island incident. These steps were taken in a standardized manner, that is to say, a number of specific measures were applied to a complete series wherever possible.

It is clear that the French standardization policy has succeeded because the safety authorities recognized that the approach by successive series was the only way of ensuring optimal reliability and safety conditions.

Then there is the issue of public opinion. We have made a special effort to explain our policy, and the success of the program itself has resulted in the acceptance of nuclear power by the public in France.

In many ways, the situation in the U.S.A. is the opposite to the French context. This applies particularly to the number of players involved, in the realms of R&D, power utilities, engineering firms, and equipment suppliers. Steps have been taken to right this situation and, above all, to compensate for the absence of any single player capable of applying a standard on a sufficiently large scale. EPRI and INPO are developing joint programs that should benefit from the experience of the entire U.S. nuclear system and start to outline the terms of a technical and industrial consensus. These organizations must be encouraged in their efforts.

Further, public confidence must be restored in the nuclear industry, otherwise nuclear power will never be accepted and will remain at a standstill. In addition to providing for the design of safer and more efficient power plants in the future, standardization will also help to restore public confidence and open the way for in-depth discussion of the safety aspects of one or several standard models. The long tradition of the U.S.A. in nuclear power, the scale of the existing system, and broadbased experience in the field mean that the technical base already exists. Now that technical base must be put to good effect.

To come back to France, I must point out that we are fully aware that the future may be very different from the past, and that as frontiers are broken down in the nascent European community, the scope for future nuclear development is expanding. Will there still be a French nuclear power program in the 21st century, or will it have been superceded by a Europe-wide venture? This internationalization process may be another factor giving renewed impetus to the nuclear power industry. We must now address the problems of federating our efforts, and bringing together the utilities, equipment suppliers, and engineering firms. Steps in this direction have been taken under the REP 2000 program, which has already acquired an international dimension. The same is true of the European fast reactor program, where a number of industrial alliances have been formed.

The future of the nuclear power industry lies in the hands of a small number of key players, both on the European and worldwide levels; a fact that will realize our hopes by further enhancing the trend towards standardization.

ANNEXES LIST

1/ Installed capacity in France early 1990 : 100200 MW

2/ The 1989 French electrical output

3/ Breakdown of national electric power production according to source

4/ French electricity generation per source

5/ Independance rate of France as regards energy

6/ Evolution of balance of electricity exports towards European partners

7/ the French PWR program life spans of different series

8/ Nuclear sites location - 8.1.1990

9/ The French PWR program main characteristics of the units general layout

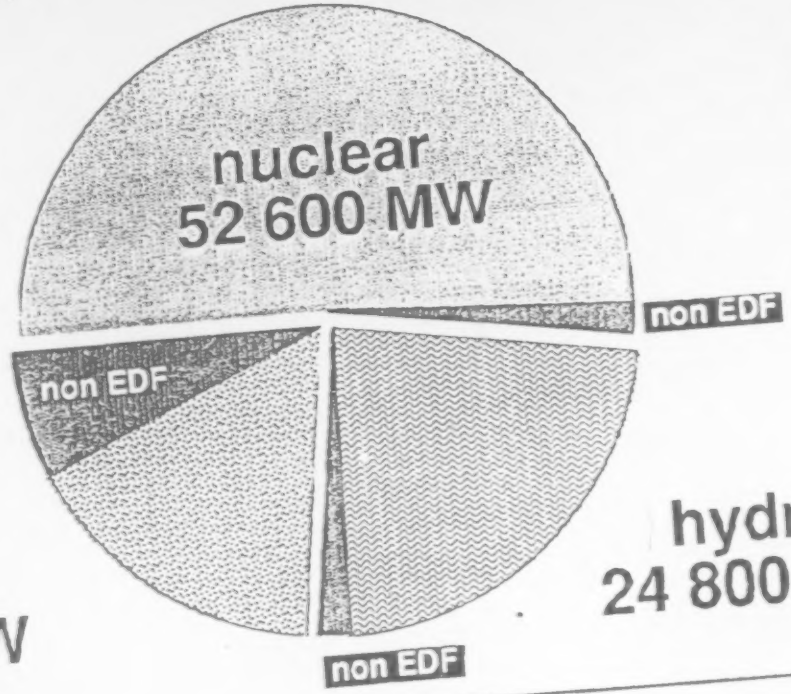
10/ The French PWR program main characteristics of the units Nuclear steam supply system

11/ The French PWR program main characteristics of the units Reactor containment

12/ The French PWR program Main characteristics of the units Conventional Island

13/ Actual construction times of 900 MW PWR units

INSTALLED CAPACITY iN FRANCE
EARLY 1990 : 100200 MW



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EDF

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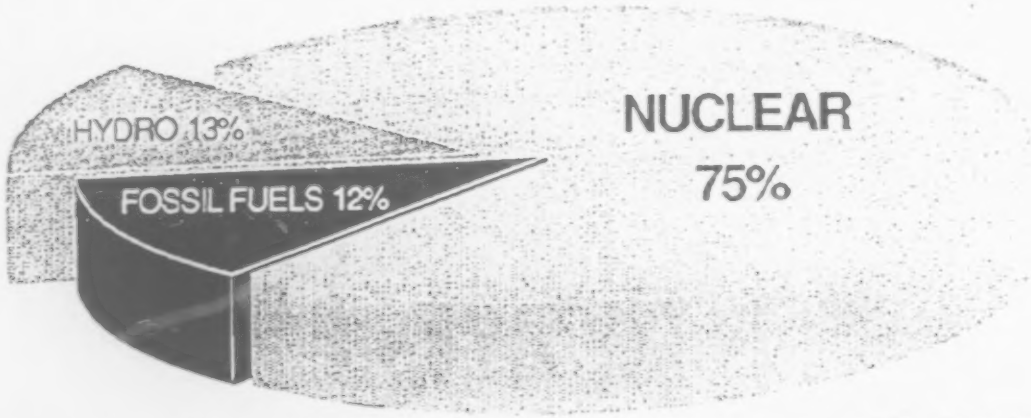
THE 1989 FRENCH ELECTRICAL OUTPUT



TOTAL : 387 TWh

1988 DATA

EDF

DE/Mission Communication - 08/02/90

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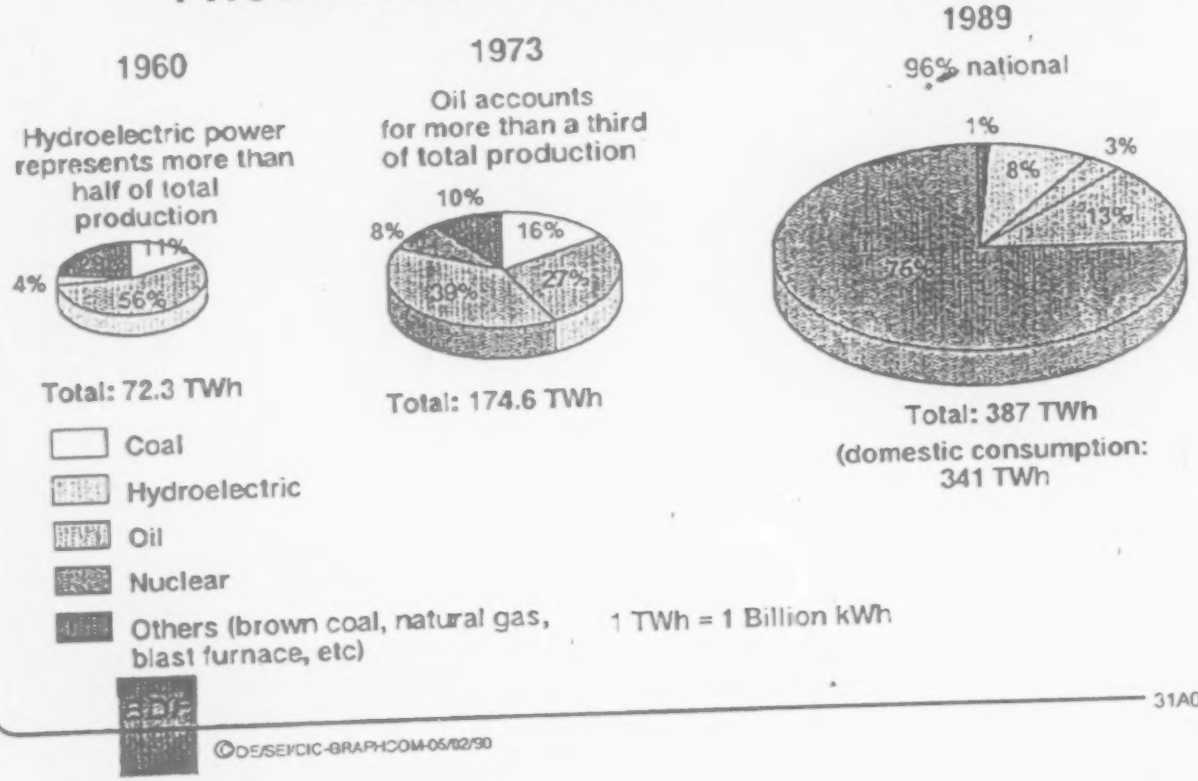
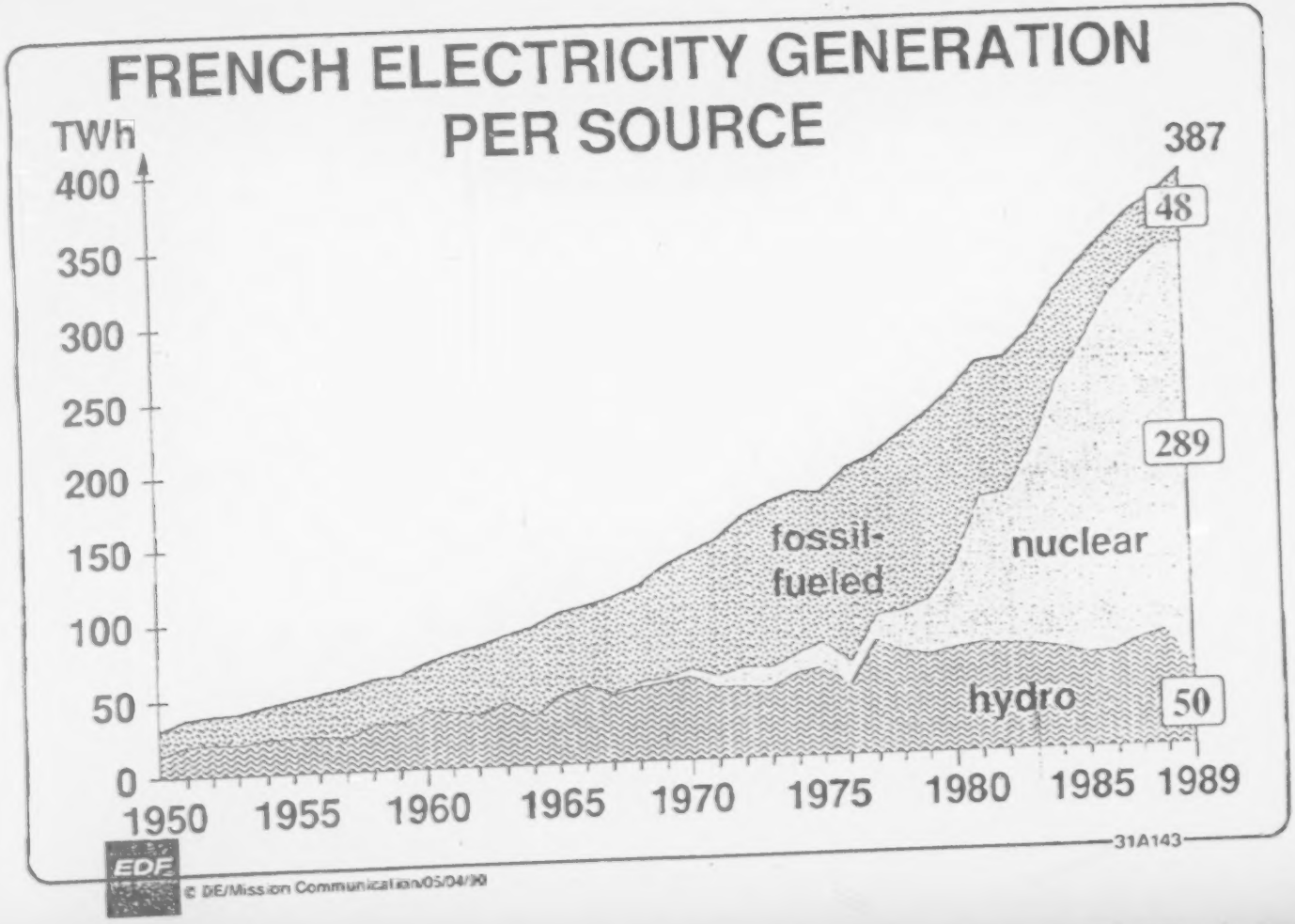
BREAKDOWN OF NATIONAL ELECTRIC POWER PRODUCTION ACCORDING TO SOURCE




FRENCH ELECTRICITY GENERATION
PER SOURCE
TWh
400
350
300
250
200
150
100
50
0
1950
1955
1960
1965
1970
1975
1980
1985
1989
387
48
289
50
fossil-
fueled
nuclear
hydro
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EDF
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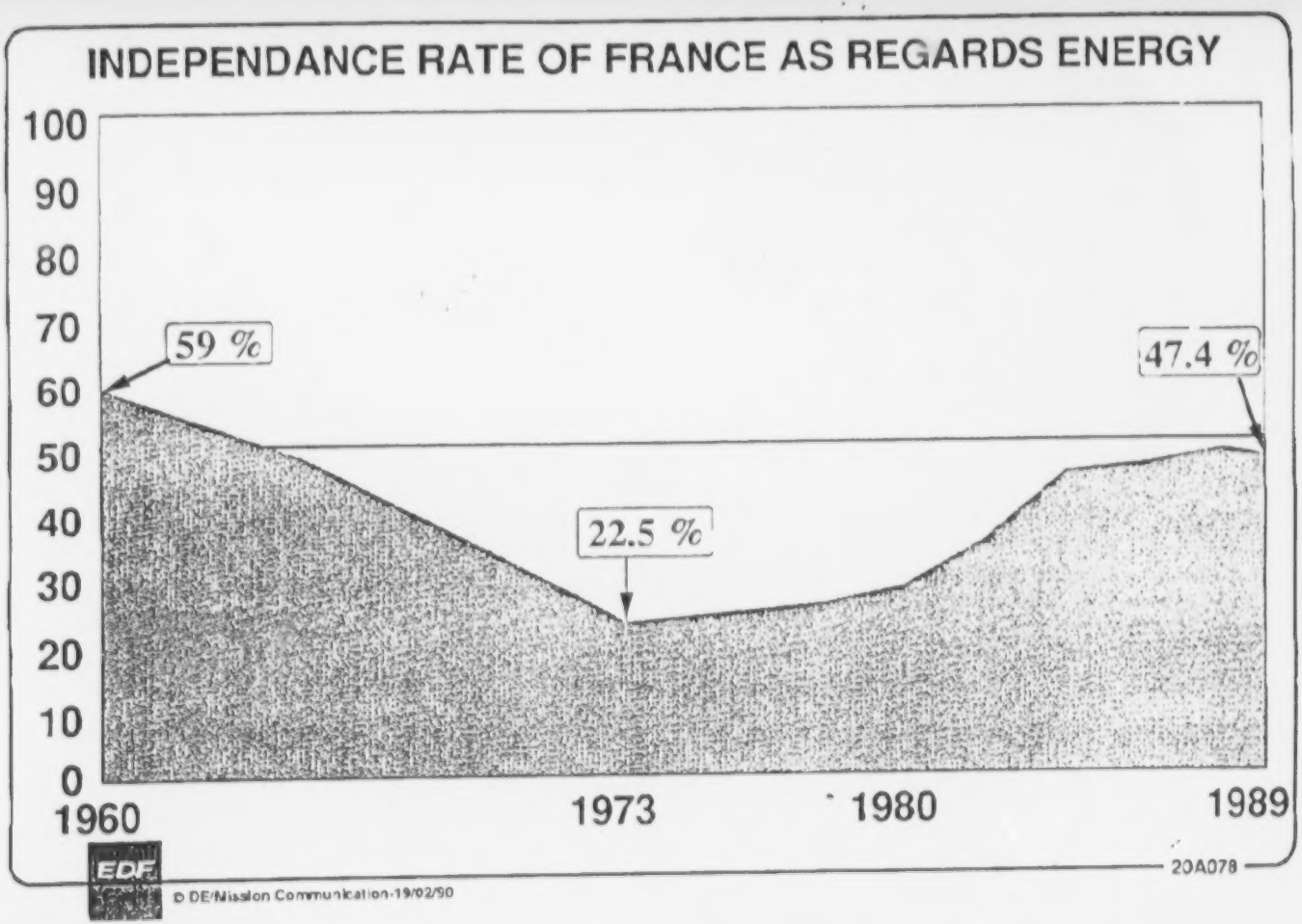
INDEPENDANCE RATE OF FRANCE AS REGARDS ENERGY
100
90
80
70
60
50
40
30
20
10
0
59 %
22.5 %
47.4 %
1960
1973
1980
1989
EDF
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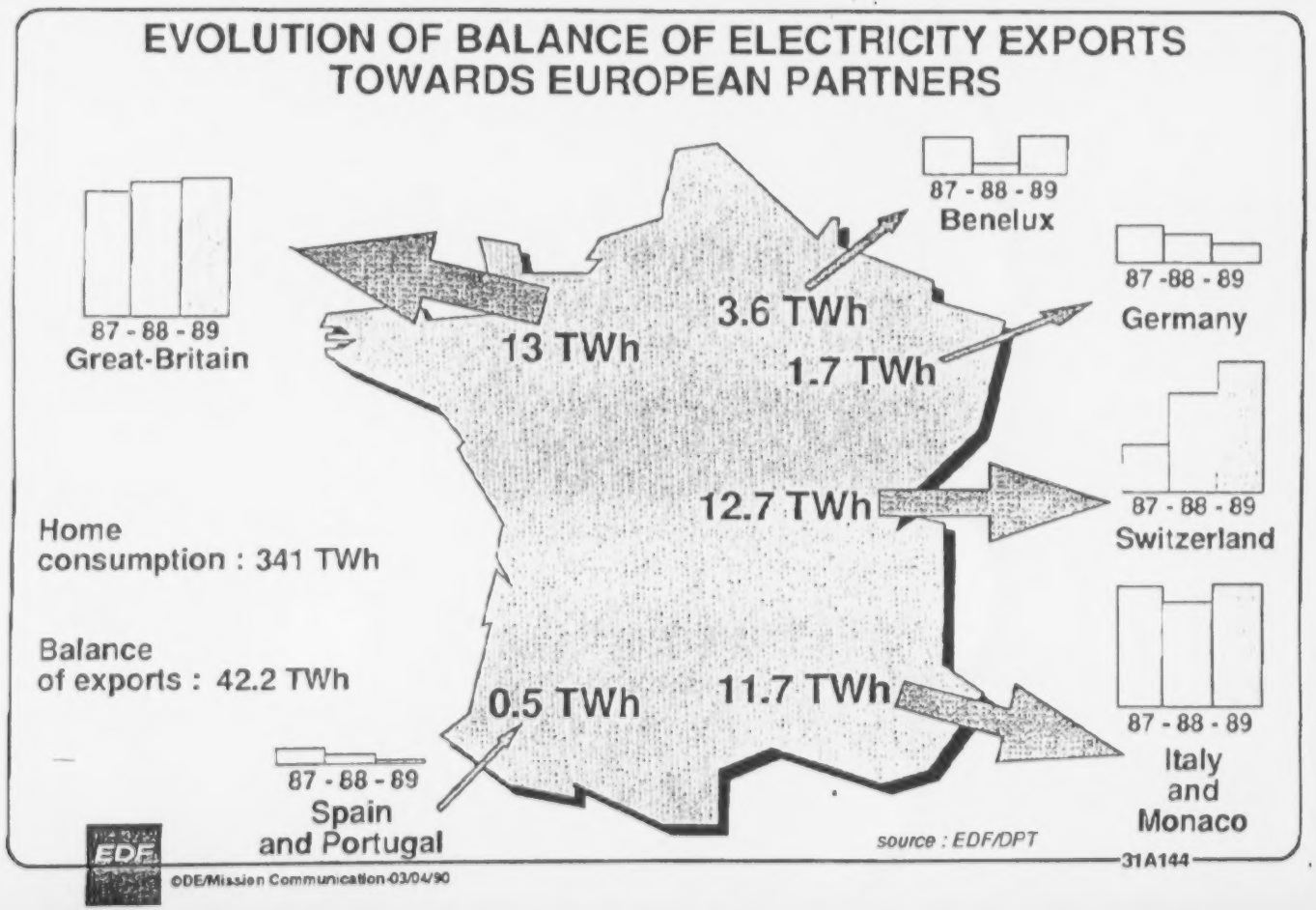
20A078


EVOLUTION OF BALANCE OF ELECTRICITY EXPORTS
TOWARDS EUROPEAN PARTNERS
87 - 88 - 89
Great-Britain
13 TWh
87 - 88 - 89
Benelux
3.6 TWh
87 -88 - 89
Germany
1.7 TWh
12.7 TWh
87 - 88 - 89
Switzerland
Home
consumption : 341 TWh
Balance
of exports : 42.2 TWh
0.5 TWh
11.7 TWh
87 - 88 - 89
Italy
and
Monaco
87 - 88 - 89
Spain
and Portugal
source : EDF/DPT
31A144
EDF
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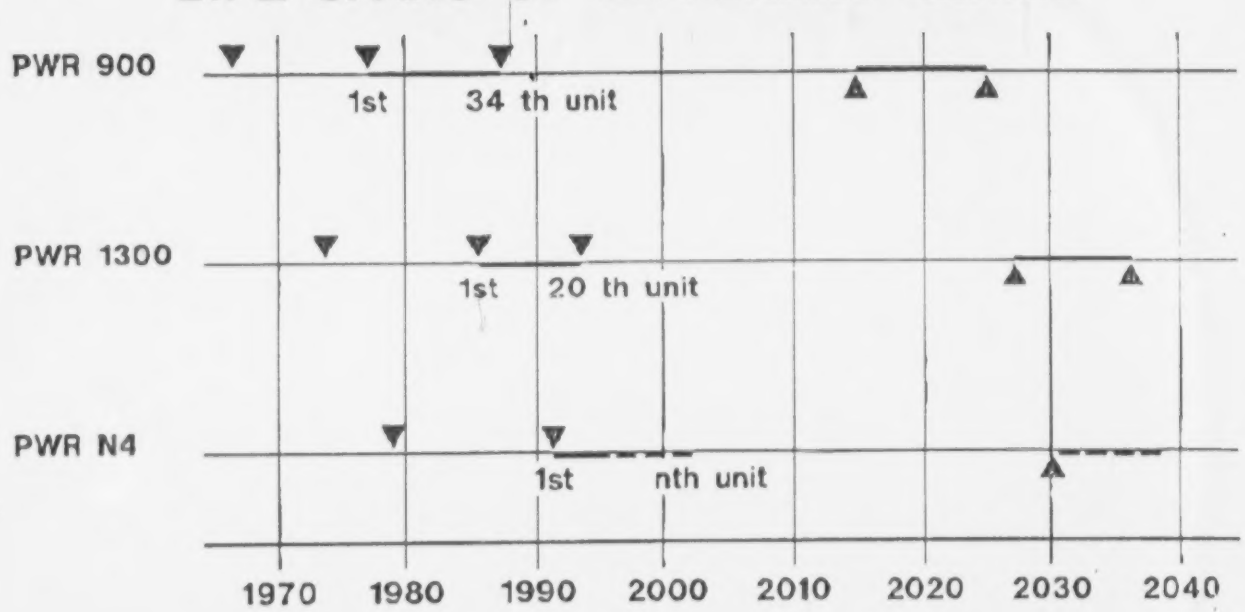
THE FRENCH PWR PROGRAM
LIFE SPANS OF DIFFERENT SERIES



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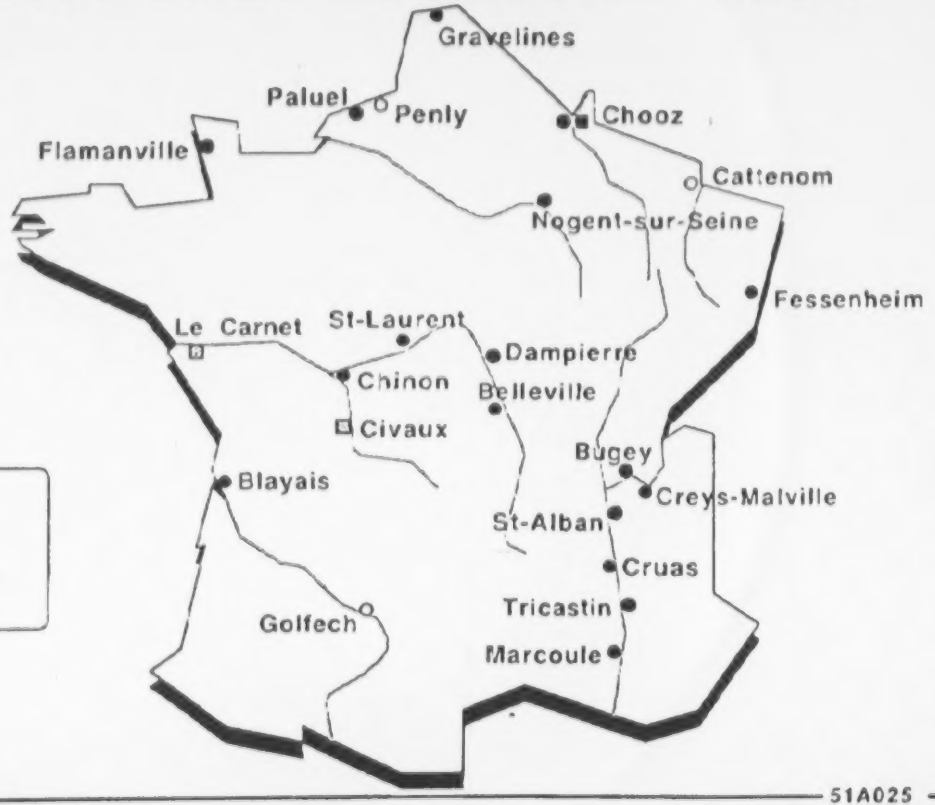
NUCLEAR SITES LOCATION - 8.1.1990



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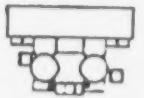
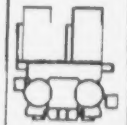
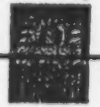
THE FRENCH PWR PROGRAM
MAIN CHARACTERISTICS OF THE UNITS
General layout

	PWR 900 MW				PWR 1,300 MW		PWR 1,400 MW
	Fessenheim	Bugey	CP1	CP2	P4	P'4	N4
Number of units:							
ordered *	2	4	18	10	8	12	2
connected to the grid *	2	4	18	10	8	9	
	TWIN UNITS				SINGLE UNITS		
GENERAL LAYOUT							

Identical nuclear island

* as at July 1st 1990



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52A037

THE FRENCH PWR PROGRAM
MAIN CHARACTERISTICS OF THE UNITS
Nuclear Steam Supply System

	PWR 900 MW				PWR 1,300 MW		PWR 1,400 MW
	Fessenheim	Bugey	CP1	CP2	P4	P'4	N4
Number of units:							
ordered *	2	4	18	10	8	12	2
connected to the grid *	2	4	18	10	8	9	
Rated thermal power	2,600 MW	2,785 MW			3,817 MW		4,270 MW
REACTOR and Reactor Coolant System	- Fuel assemblies: 157 - Assembly height: 4.058 m - Vessel diameter: 3.98 m - Inlet temperature: 288°C - Outlet temperature: 324°C			3 loops	- 193 a. - 4.795 m - 4.39 m - 293 °C - 329 °C	4 loops	- 205 a. - 4.795 m - 4.49 m
STEAM GENERATOR	- Height: 20.6 m - Heat transfert area: 4,751 m² - Steam absolute pressure: 57.5 bar				22.3 m 6,936 m² 72 bar		21.9 m 7,300 m² 73.3 bar
COOLANT PUMP	- Flow rate: 21,250 m³/h - Electrical power (hot conditions): 5,400 kW				23,300 m³/h 5,910 kW		24,500 m³/h 6,600 kW
Handling of heavy components	- Polar crane on internal structures. - Equipment hatch at ground level		- Polar crane on corbels - Equipment hatch at service floor level, with an outside metal gantry.				

* as at July 1st 1990

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THE FRENCH PWR PROGRAM
MAIN CHARACTERISTICS OF THE UNITS
Reactor Containment

	PWR 900 MW				PWR 1,300 MW		PWR 1,400 MW
	Fessenheim	Bugey	CP1	CP2	P4	P'4	N4
Number of units:							
ordered *	2	4	18	10	8	12	2
connected to the grid *	2	4	18	10	8	9	
REACTOR CONTAINMENT	With steel liner				H: 71.9 m Ø: 45 m	H: 62 m Ø: 43.8 m	H: 63.2 m Ø: 43.8 m
	H: 51.3 m Ø: 37 m		H: 57 m Ø: 37 m		EQUIPMENT HATCH		
	EQUIPMENT HATCH		EQUIPMENT HATCH				
Design pressure (bar)	4.7	5	5		4.8	5.2	5.3

* as at July 1st 1990

Dimensions are measured from the ground level

52A040

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THE FRENCH PWR PROGRAM
MAIN CHARACTERISTICS OF THE UNITS
Conventional Island

	PWR 900 MW				PWR 1,300 MW		PWR 1,400 MW	
	Fessenheim	Bugey	CP1	CP2	P4	P'4	N4	
Number of units:								
ordered *	2	4	18	10	8	12	2	
connected to the grid *	2	4	18	10	8	9		
NET ELECTRICAL OUTPUT							Load following	Base load
once-through cooling:	880 MWe	920 MWe		—	1,290 MWe		1,390 MWe	1,465 MWe
cooling tower:	—	900 MWe		880 MWe	1,270 MWe		1,375 MWe	1,455 MWe
TURBINE	1 double-flow HP cylinder + 3 double-flow LP cylinders			1 HP + 2 LP (double-flow) identical LP cylinders	1 HP + 3 LP cylinders		1 HP + 1 LP + 3 LP cylinders	
	Alsthom Technology			BBC Technology			Arabelle (Alsthom Technology)	

* as at July 1st 1990

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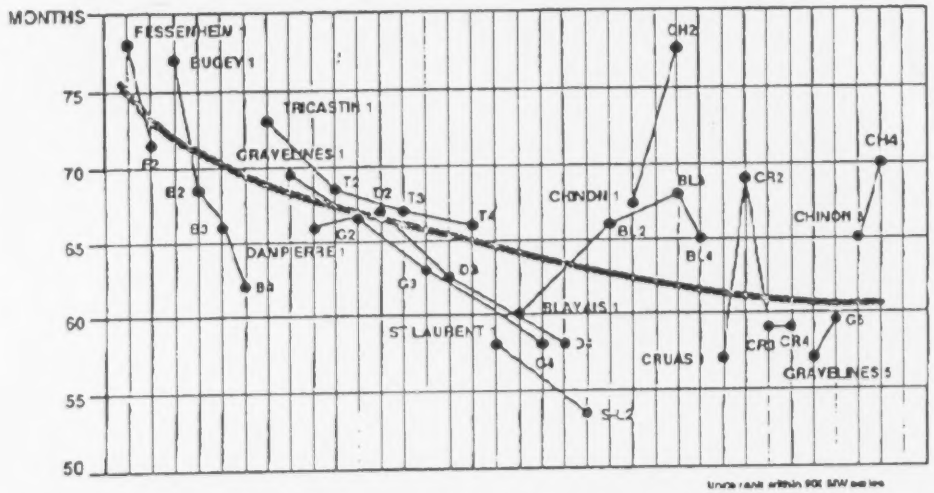
ACTUAL CONSTRUCTION TIMES OF 900 MW PWR UNITS

(Construction time from boiler commitment to first connection to the grid)



When the apprenticeship effect is evident on the whole, some of the latest units have experienced some specific difficulties in their realization.

55A052

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